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TUMOURS AND CYSTS OF THE MEDIASTINUM. PART TWO*

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NEUROGENIC TUMOURS.

TUMOURS of nerve origin are the most common of the growths of the mediastinum.

They almost all lie in the posterior mediastinum and of 172 cases we have been able to analyze, in only 6 were the tumours placed in the anterior mediastinum. Of these, five were malignant tumours of nerve sheath origin, one of which had originated in a teratoma (Godwin *et alii*, 1950). The only benign tumour was a neurofibroma of the phrenic nerve (Cutler and Gross, 1936). The site of origin of the other tumours was not evident from the case reports.

Willis (1948) classifies these neurogenic tumours very simply into those which arise from nerve sheaths and those which arise from nerve cells.

The tumours of nerve sheaths he further subdivides into neurilemmomata or Schwann cell tumours also known as neurinomata, and the neurofibromata.

The neurilemmomata (more correctly called neurolemmomata) are usually solitary tumours and are characterized by the regimentation of the cells into fasciculi or palisades. The neurofibromata are often multiple and part of a general neurofibromatosis and their characteristic is the presence of whorls of fibrous tissue.

The nerve cell tumours he separates into neuroblastomata or tumours consisting of immature undifferentiated neuroblasts and ganglioneuromata or tumours consisting of well-differentiated nerve cells and fibres.

In the neuroblastoma the characteristic is the "rosette" arrangement of the cells; the tumours grow rapidly and are malignant. In the ganglioneuroma the ganglion cell is the characteristic feature; the tumours grow slowly and are benign. All gradations between these two extremes are found. The most frequent sites of origin for these tumours are the sympathetic ganglia and the adrenal glands.

Kent *et alii* (1944) surveyed a series of 91 neurogenic tumours of the mediastinum of which 17 cases were their own. Of these tumours 22 (24 per cent.) were malignant. But this figure seems much too high for, of the 172 cases we have been able to collect which include those of Kent and his colleagues, only 26 or 14.8 per cent. were malignant. Kent based some of the diagnoses in his own series of 17 cases on the invasive qualities of the tumours rather than the nature of the cells and possibly if this were done the number of malignant cases reported by others would be greater.

Of the 172 cases, in 125 further data was available. In 61 of these 125 cases the tumours were of nerve sheath origin and 11 (17 per cent.) were malignant. In 49 the tumours were ganglioneuromata of which 6 (12 per cent.) were malignant. Of 100 cases for which data is present, 77 per cent. were

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in the superior or upper mediastinum and 23 per cent. in the inferior mediastinum. There was no predilection for one side. The patients in Kent's series were divided equally as to sex. In the later series, which have been influenced by mass surveys, there is a preponderance of males for the reason given earlier. The average age of the patients with ganglioneuromata was 16 years as compared with 34 in those with nerve sheath tumours.

The symptoms produced by these tumours fall into three groups; those due to pressure on nerves, such as pain which may radiate from the chest down the arm, into the shoulder and into the neck; Horner's syndrome due to involvement of the cervical sympathetic or wasting of the small muscles of the hand from pressure on the first dorsal nerve; those due to pressure on the bony cage of the thorax such as pain and radiological evidence of erosion of ribs or vertebrae; and those of respiratory origin, such as cough, dyspnoea and even occasional haemoptyses, the mechanism of which is not easy to explain.

These tumours may extend into the spinal canal. If they do there may be erosion of the pedicles of the laminae and the intervertebral canals may be widened. There may be evidence of pressure on the spinal cord.

Severe pain is usually suggestive of malignancy as is an irregular erosion of the ribs or vertebrae caused by infiltration rather than pressure. Quick growth is also suggestive.

The tumours may become very large particularly those which occur in the inferior mediastinum.

The ganglioneuromata which occur in the superior mediastinum are often associated with either a Horner's syndrome or a dilated pupil on the same side due to stimulation of the cervical sympathetic.

Many large nerve trunks may be seen going into the tumour which often extends into the neck close to the first dorsal nerve and which may surround or engulf the subclavian artery. This constitutes a very real hazard in the surgery of these tumours as the artery is hidden from the surgeon by the bulk of the tumour; if it appears probable that the subclavian artery is embedded in the tumour enough of the tumour must be removed to enable control of the artery to be obtained. Failure to appreciate this state of affairs has been responsible for many of the recorded fatalities.

In our case the artery was embedded in the tumour and, after removal of enough of the tumour to obtain access to it, had to be ligated.

The treatment of the tumours is undoubtably removal if possible. Bulk is the chief obstacle in the benign tumours but in the malignant ones fixation may prevent removal.

The prognosis is good in the well-differentiated tumours and appears to be good in the operable tumours. The malignant tumours are not sensitive to radiotherapy. If the tumours extend into the spine both portions should be removed and it is generally considered that the spinal portion should be done first if a one stage operation is inadvisable. Many authors emphasize the incidence of haemorrhage and shock after operation. Andrus (1940) has suggested the use of a tourniquet or snare to control haemorrhage until the bulk of the tumour is removed, when the vessels can be secured under vision.

The tumours may be quite symptomless and many have been found accidentally at autopsy—20 per cent. in Heuer and Andrus (1940) series of 100 collected cases.

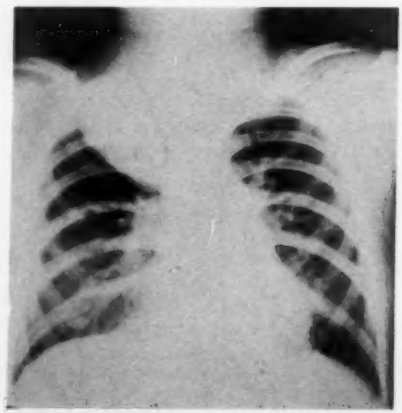

FIG. XVIII. Case 12. Postero-anterior X-ray. Ganglioneuroma. Note clear-cut lower border.

The 172 cases reviewed here were collected from Kent *et alii* (1950) 91 cases, Bradford *et alii* (1947) 6 cases, Silveus and Adams (1947) 3 cases, Brewer and Dolley (1949) 17 cases, Blades (1946) 30 cases, Godwin *et alii* (1950) 20 cases, Staffner *et alii* (1943) 3 cases, Hochberg (1950) 1 case and one case now reported.

Case 12.

A female, aged 9½ years developed, 18 months previously, an irritating cough which ceased for a few months after tonsillectomy. The cough returned. Six months previously she had complained of nausea and occasional feverishness and had frequent colds; 4 weeks previously she developed a cold which had persisted and, on radiological examination, a tumour was seen in the chest.

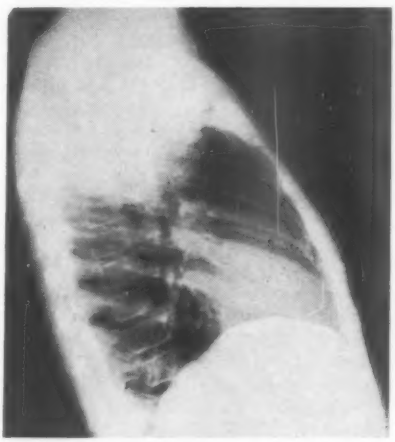

FIG. XIX. Case 12. Lateral X-ray. Ganglioneuroma. Note rounded margin.

On examination she was a healthy looking child. The right side of her face was warmer and drier than the left and the right pupil was smaller than the left. Both pupils reacted to light and on convergence and dilated on stimulation of the neck. The trachea was midline in position.

There was diminished air entry to the right lung apex and an occasional rhonchus was found in the same area but there were no other relevant physical signs. There was no muscular wasting.

Radiological studies showed that there was a dense tumour in the posterior portion of the right side of the chest extending from the 1st to the 5th rib. The tumour had a well-developed rounded lower margin and bronchograms showed it to be extra-pulmonary.

At operation on 4th Nov., 1949, a posterior approach was made, the pleura was opened and a hard rounded mass was found which filled the apex of the right chest; the tumour was extrapleural. It was freed easily except at the apex. There were numerous large nerve bundles about one-eighth of an inch in diameter running into the tumour. During the separation at the extreme apex it was seen that the subclavian artery was surrounded by the tumour and in efforts to free it the artery was cut. It was secured without difficulty and ligated after removing the main bulk of the tumour which obscured the artery. The rest of the tumour was then freed and removed. It extended into the neck, and towards the vertebral canal there was a small prolongation which was also removed. During the dissection it was apparent that a large nerve trunk in the position of the first dorsal nerve entered the substance of the tumour. It could not be separated from the tumour and when stimulated caused movements in the small muscles of the hand. As it was impossible to remove the tumour without dividing the nerve, this was done.

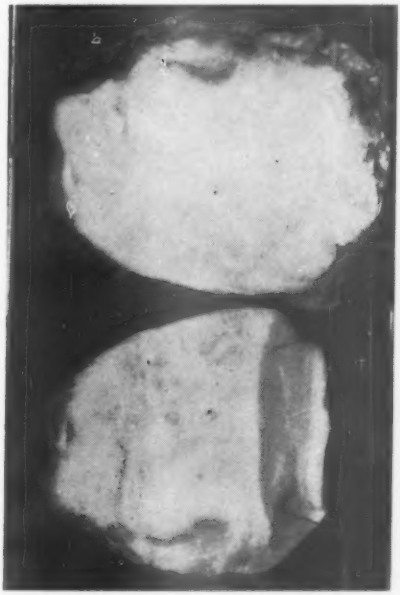

FIG. XX. Case 12. Photograph of ganglioneuroma after removal.

Post-operatively she ran an uneventful course although the right upper lobe was slow to expand fully.

Histological examination showed that the tumour consisted almost entirely of mature cells with several areas of ganglion cells. In only one small area examined there were some relatively immature cells (Figs. XVIII, XIX, XX and XXI).

The patient, at follow-up eighteen months later, remains very well, her mentality is exceptionally good for her age, and her intelligence well above the average. At no time since the operation has she had any loss of function of any sort, sensory or motor, in the right upper limb. There is still

no pulsation in the vessels of the right wrist, her right arm is the same in all its measurements as the left arm, there is some wrinkling of the skin of the palm of the right hand, the right side of her face and her arm are dry and warm, and a Horner's syndrome persists. The child herself notices no disability from the Horner's syndrome.

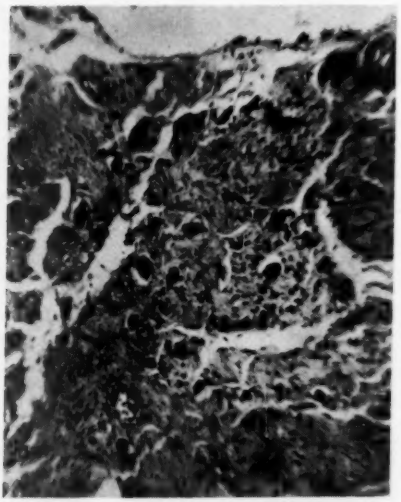

FIG. XXI. Case 12. High power photomicrograph of ganglioneuroma. (x 350.)

Comment.

After removal of the tumour a careful search was made in the area to see if there was an intact nerve in the region of the first dorsal nerve, but only a stump of divided nerve could be seen. It is difficult to understand why there was no loss of function in the hand unless there is a prefixation of the brachial plexus.

TUMOURS OF THE OESOPHAGUS AND TRACHEA.

Oesophageal tumours rarely present with symptoms other than dysphagia but on the other hand many of the mediastinal tumours cause dysphagia and so these tumours must be considered. The diagnosis of these tumours depends more on oesophagoscopy than on radiological examination. Benign tumours include bronchogenic cysts, fibromata, leiomyomata and paraganglionomata.

Lesions of the oesophagus are distinguished by dysphagia and rarely do they grow to a size large enough to be seen on ordinary radiological examination of the chest. The malignant growths produce dysphagia of such a degree that diagnosis is easy if the patient is examined with the oesophagoscope.

Tumours of the trachea are by no means common and most of them present on the mucosal aspect and are diagnosed by bronchoscopy. McDonald, in 1946, reported 27 cases of which eight were cylindromata and two haemangio-endotheliomata.

Almost all of these presented as endoscopic problems.

We have one case in which there appeared to be a tumour of the trachea. However, as biopsy examinations were unsatisfactory this is by no means certain. There was a nodule seen at bronchoscopy and it was part of a rounded swelling which was attached to and apparently arose from the right wall of the trachea. Its long axis coincided with the axis of the trachea. It measured about 2 inches by 3 inches and it extended above and below the arch of the aorta.

It is possible that this is a cylindroma. One of the characteristics of this tumour is that there is often an intact mucosa over the tumour and it is possible that the nodule which projected into the lumen was a portion of the tumour covered with normal structures and only these were obtained in the biopsy examinations. The alternative diagnosis of a tumour of the lymphoma group seems unlikely in that the position of the tumour is unusual. Growth of a lymphoma into the lumen of the trachea is most unusual, as is haemoptysis.

Chondromata have been described on the mucosal aspect of the trachea and presumably they could grow externally as well, and in that case might resemble this tumour. The youth of the patient would be in keeping with an absence of calcification in the tumour.

Case 13.

A male, aged 21, was admitted to hospital because of a history of two years duration of pain in the right upper chest. The pain was not constant but recurred on several occasions. One month previously he coughed up some bright red blood and had done so once subsequently. His pain recurred with each haemoptysis. He had little cough but said he produced occasional sputum.

On examination he was mentally very dull and not very co-operative. His blood pressure was 120/90 mm. of mercury. There were no physical signs of disease in the chest or other systems.

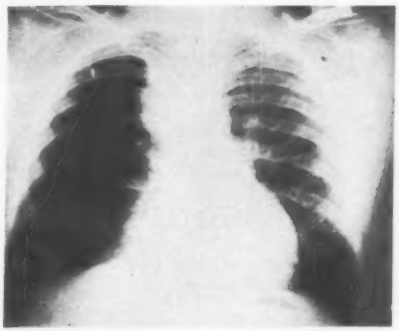

FIG. XXII. Case 13. Postero-anterior X-ray. Tumour of the trachea.

Radiological examination showed a rounded tumour two inches by three inches projecting from the right side of the mediastinum above the right bronchus and over the trachea (Figs. XXII and XXIII). The oesophagus was normal.

Streptococci, pneumococci and *micrococcus catarrhalis* were found in the sputum but no acid fast organisms. Blood count was normal; Wassermann reaction was negative; and blood sedimentation rate 9 mm. in 60 minutes (Cutler method).

On bronchoscopy a nodule was seen on the posterior portion of the right side of the trachea wall just above the orifice of the right bronchus. It projected into the lumen for about 2 mm. A smaller nodule was visible on the posterior wall opposite the orifice of the right upper lobe bronchus. A piece was removed for histological examination.

Histological report was that the tissue submitted was disorganized and anatomical relations were abolished. It was very cellular but it was impossible to say it was neoplastic.

At subsequent bronchoscopy the larger nodule was no longer evident; the smaller was removed.

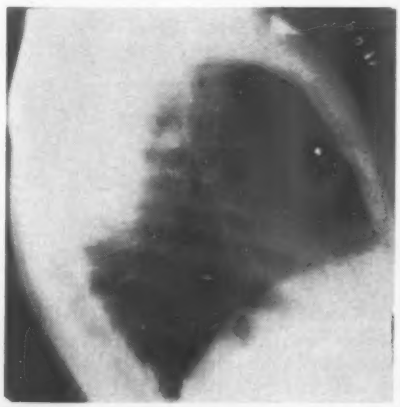

FIG. XXIII. Case 13. Lateral X-ray. Tumour of the trachea.

A pneumothorax was induced which showed that the tumour was closely related to the lateral aspect of the trachea just above the bifurcation.

At thoracoscopy the situation of the tumour was confirmed. The mediastinal aspect of the lung was adherent to the dome of the tumour which gave a transmitted pulsation and a vein coursed over the pleural aspect of the tumour. A further bronchoscopy showed that the nodule had reappeared in the same situation above the orifice of the right bronchus. The nodule was removed by forceps; as on the previous occasion it was smooth and reddish in colour. Biopsy examination on this occasion revealed only normal tracheal structures.

Operation was advised but refused by the patient who returned to the bush and has not since been seen.

TUMOURS OF CARDIO-VASCULAR ORIGIN.

Tumours of cardio-vascular origin form an important group because of the difficulties they present in diagnosis from teratomata. The tumour most frequently seen is an aneurysm of the aorta. These may be very large. Rarely small saccular aneurysms arising from the posterior surface of the aorta with a small opening into the lumen of the aorta may simulate a benign tumour near the bifurcation of the trachea.

There are often areas of calcification in the walls of the aneurysms which may be seen on radiological examination. Typically an aneurysm should exhibit expansile pulsation but often it does not pulsate at all.

The aneurysms produce symptoms by pressure on trachea or bronchi, on nerves, or on the bony cage of the thorax. Cough, dyspnoea, palpitation, alteration in the voice, and pain, constant and continuous are the main symptoms. The Wassermann reaction may be positive in aneurysms but even when positive a tumour may not be an aneurysm. On radiological examination it may be possible to demonstrate continuity of the tumour shadow with the aorta and this is a good point in diagnosis. Injection of contrast media, however, may make the diagnosis certain.

The aneurysms of the ascending aorta and the aortic arch are anterior in position and so most confusion will arise in diagnosis from a teratoma.

External pulsation or erosion of the sternum suggests aneurysm.

Treatment of these aneurysms so far has consisted of some attempts to promote clotting in the sac and so thicken the wall of the aneurysm. The methods used have involved the application of an irritant either inside or outside the sac.

The internal method usually used is the introduction of a coil of wire into the sac through a small canula. Moore first attempted this in 1864. Since then, sundry embellishments have developed which include passing an electric current through the wire. Colt (D'Arcy Power, 1921) used a number of pieces of stiff wire bound together at one end in the form of an umbrella frame. This is carried in a canula which in turn is passed down an outer canula, introduced with a trocar into the aorta. The umbrella is then pushed out of the inner canula by a ramrod. The method has produced some spectacular results in saccular aneurysms of the arch of the aorta; the results in aneurysms of the ascending aorta are not so good.

We have used the method twice. In both patients there was immediate alleviation of symptoms with increase in vital capacity. One patient lived for four months and the other for five; both died of rupture of the aneurysm. Polythene films have been used also with great success (Poppe and de Olivera, 1946; Cowley, Sloan and Sullenberger, 1951) to produce irritation and clot formation in aneurysms. The film is applied in strips over the surface of the aneurysm. The method is applicable to fusiform as well as saccular aneurysms.

Decompression of the mediastinum to relieve the pressure symptoms and the formation of an arterio-venous fistula to diminish the pressure in the aorta have also been tried.

All these methods also may relieve the pain and paravertebral injections have been used for the same purpose.

Tuffier attempted without success to excise the sac (King, 1941).

Case 14.

This patient was a male aged 60, admitted on 21st July, 1948. For five years he had had bronchitis, and increasing dyspnoea. For one month his cough was worse. He had lost 10 lbs. in six months. He had had to sleep with several pillows and was subject to dyspnoeic attacks in the early hours. There had not been haemoptysis.

On examination he was somewhat wasted, he could not lie flat in bed without distress and on doing so his face became red. His blood pressure was 120/80 mm. of mercury. His apex beat was in the 5th left intercostal space 4 inches from the midline. His heart was regular; there was a systolic bruit at the aortic area. There were some dilated veins over the anterior aspect of the right chest. There was dullness to the right of the sternum for about four inches; pulsation was palpable over this area and sometimes a systolic murmur could be made out. There was dullness posteriorly in the corresponding area. There were numerous rhonchi throughout both lungs. There were no other relevant findings.

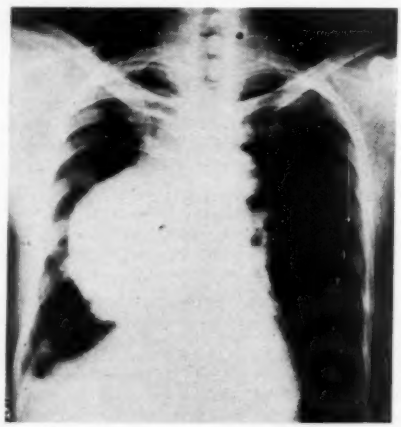

FIG. XXIV. Case 14. Postero-anterior X-ray. Aneurysm of the arch of the aorta.

His Wassermann reaction was positive, Casoni reaction was negative. Bronchoscopy disclosed a flattened right main bronchus.

Radiological study showed there was a rounded opacity in the right side of the anterior mediastinum. It was four inches in diameter and seemed to arise at the hilum of the lung. There was calcification in the mass, which did not pulsate. After diagnostic pneumothorax the mass appeared to be non-vascular in origin. At subsequent examination it was thought that there was pulsation in the upper portion of the tumour which appeared to be continuous with the aorta.

Aneurysm seemed to be the most likely diagnosis but in view of former errors a small diagnostic thoracotomy was made through an intercostal incision. The diagnosis of aneurysm was confirmed.

Post-operative course was uneventful.

A Colt's umbrella was procured and introduced three months later.

His general condition on his discharge from hospital showed considerable improvement. His

dyspnoea was less and his vital capacity had increased from 2,600 cc. to 3,600 cc. He had symptoms suggestive of a cerebral embolus about three weeks after the wire was inserted. The attack lasted only fifteen minutes and cleared up entirely.

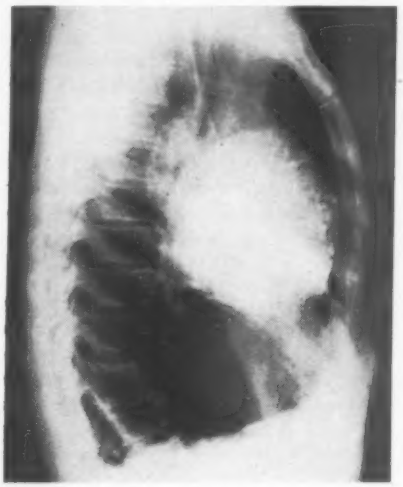

FIG. XXV. Case 14. Lateral X-ray. Aneurysm of the ascending aorta. Note the calcification in the wall and the aortic shadow behind and above the aneurysm.

His general condition remained good until four months later when he died suddenly. Autopsy showed that the aneurysm had ruptured into the pericardium (Figs. XXIV, XXV and XXVI).

FIG. XXVI. Case 14. Lateral X-ray. Umbrella in aneurysm of the ascending aorta.

Case 15.

A male, aged 51, had had dyspnoea on exertion for six months with occasional haemoptysis. The symptoms became worse and he then developed pain in both shoulders and across the back.

On examination there was an area of dullness to the right of the sternum anteriorly. His blood pressure was 125/90 mm. of mercury. The Wassermann reaction was negative.

Radiological examination disclosed a large rounded opacity with a calcified margin continuous with the shadow of the aorta. The tumour did not pulsate. The diagnosis was teratoma of the right anterior mediastinum.

At thoracotomy by an anterior approach a yellowish white tumour was seen, projecting into the right chest from the anterior mediastinum. There was a plaque of calcification on the anterior aspect of the tumour. There was no pulsation in the tumour and the diagnosis of teratoma appeared to be confirmed. An attempt was made to free the tumour and, in the process, a small opening was made on the anterior surface of the mass. A little yellowish fluid which looked like liquid fat escaped.

After almost two-thirds of the circumference of the tumour had been freed pulsations suddenly began. The opening in the wall was closed and reinforced with a strip of pleura. At no time was there an escape of blood from this opening.

Post-operatively, blood stained fluid was removed from the pleural cavity on several occasions, but eventually the lung expanded fully.

Six weeks after thoracotomy a Colt's umbrella was inserted under local anaesthesia. There was an immediate improvement in his dyspnoea and his pain was less. His vital capacity improved from 1,900 cc. to 2,600 cc. His improvement was maintained for two to three months but then pain returned and he developed a cough. He died of sudden haemorrhage five months after the wire was inserted; as this occurred in the country, no autopsy was made.

Tumours of the heart muscle are usually malignant but occasional benign tumours, such as fibromata and myxomata, have been reported. Beck (1942) succeeded in the removal of such a benign tumour from the wall of the left ventricle. The pre-operative diagnosis was benign tumour of the heart. The tumour was a cyst with a thick wall comprised of connective tissue, of which the interior aspect was necrotic and calcified; there was not enough evidence on which to make a definite diagnosis. No doubt, as Beck suggests, with the further development of the artificial heart, an attack may be possible on the tumours within the lumen of the heart.

We have one malignant cardiac tumour.

Case 16.

A male of 37 years had a history of seven months duration; he had collapsed once with aches and pains all over and had had paralysed arms for two days. One month previously he coughed

up a small amount of blood. Since then he had become increasingly dyspnoeic. For one day he had severe cough and pain in the left lower part of the chest anteriorly and later coughed up a considerable quantity of frothy pink blood; he had extreme dyspnoea. His blood pressure was 130/80 mm. of mercury. He died shortly after admission from pulmonary oedema.

Post-mortem examination disclosed bilateral pleural effusions and his lower lobes were almost airless.

There was a sessile lobulated tumour 3½ x 2½ x 2 inches arising from the antero-medial wall of the left atrium. It was pale yellow in colour and firm in consistency except for some cystic areas in the middle which contained dark brown fluid. It almost filled the left atrium and almost blocked the orifice of the left pulmonary veins. Three small sessile leaflike projections arose from the wall of the right inferior pulmonary vein.

Histologically the tumour was a fibro-myxo-sarcoma.

FIG. XXVII. Case 16. Fibro-myxo-sarcoma of the left atrium. Photograph of the heart. The tumour almost fills the left atrium. There are darker areas of haemorrhage on the surface of the tumour.

The figure shows the tumour in the left atrium. Radiological examination in postero-anterior projections on three occasions during five months had demonstrated congestion of the lungs which in the picture taken on admission was very gross.

There was no suggestion of the tumour in any of the films (Fig. XXVII).

TUMOURS OF THE THYMUS GLAND.

The first report of the association of myasthenia gravis with a thymic tumour was by Weigert in 1901. Since that time such tumours have been reported with ever increasing frequency quickened by the renewed interest in myasthenia which resulted from the introduction of prostigmine in treatment and by the reports of operations on the thymus.

Seybold, McDonald, Clagett and Good in 1950 published a series of 45 tumours of the thymus. Of these, 75 per cent. had evidence of myasthenia gravis. Of their cases of myasthenia, 15 per cent. only had tumours of the thymus. They are of the opinion that a causal relationship between the thymic tumour and myasthenia gravis is highly unlikely.

They point out the various difficulties in classification of tumours of thymic tissue which are aggravated by the inclusion of tumours which may arise in the stroma of the gland. In addition degenerative changes in the gland obscure the picture. They believe that in the past many cases of carcinoma of the lung, such as the oat-celled type, with secondary deposits in the lymph nodes in relation to the thymus have been described as thymic tumours.

They suggest that the term thymoma should be applied to these tumours as it is noncommital. Their definition is that it is a slowly growing tumour of the thymus which has arisen from both the epithelium (reticulum) and thymocytic elements of the thymic parenchyma.

The tumours may have a dense fibrous capsule with distinct fibrous trabeculae. There may be foci of necrosis, of cyst formation and areas of calcification. All contain the thymic lymphocyte or thymocyte and the thymic epithelial cell in varying proportions. The average age of their patients with tumour and myasthenia gravis was 45.5, with extremes at 26 and 68. In the cases without myasthenia gravis the average age was 43 with extremes of 16 and 65. With myasthenia gravis, 20 of 34 tumours occurred in females, and in the cases without myasthenia gravis 8 out of 11 were females.

Pain occurred in only four patients in each group and obstruction of vena cava in three cases and one respectively. There was radiological evidence of mediastinal tumour

in all cases but one. The non-myasthenic tumours in seven cases were found by routine radiological examination.

The tumours are usually situated in the anterior mediastinum though one of Seybold's cases was in the posterior mediastinum. The majority are anterior to the arch of the aorta and base of the heart but examples may occur much lower in the thorax. They are usually round or oval with sharp outlines but they may be flattened. They may be lobulated. Thirteen out of 45 showed calcification visible radiologically.

The various descriptions of the pathological appearances of these tumours, these authors believe, depend on the proportions of the thymocytes and thymic epithelial elements present. If the former predominate the designation has been lymphosarcoma, while predominance of epithelial elements give a resmblance to carcinoma or epithelioma.

They were unable to distinguish the tumour with, from that without, myasthenia on either gross or microscopic examination. Cysts with no tumour cells in their walls were found in three cases of myasthenia gravis. Hassall's corpuscles were found in only 11 of the tumours. Ten of the 45 tumours invaded contiguous structures and two spread to pleural surfaces by implantation; none produced secondary deposits.

These authors believe that the treatment of these tumours should be surgical removal, as many of them are malignant, and a diagnosis is only possible by inspection. They found that intensive deep X-ray therapy sometimes influenced the tumours.

It is important to note that curare should not be used in operations on patients with myasthenia gravis as the symptoms may be aggravated. All patients with myasthenia gravis must be stabilized on prostigmine prior to operation and arrangements made for maintenance during the time of the operation.

There remains for consideration the enlargements of the thymus found in infants, in whom the tumours may almost fill one side of the thorax. The trachea then becomes angulated and there may be stridor and dyspnoea. The tumours respond well to deep X-ray therapy (Figs. XLI and XLII).

TUMOURS OF THYROID ORIGIN.

Goitres or portions of the thyroid gland are frequently found in the chest and the incidence of this type is probably about 15 per cent. of all goitres.

These goitres may be part of a cervical swelling which extends under the sternum—the retro-sternal goitre; they may be almost entirely retro-sternal, and appear in the neck only when the patient coughs or swallows—the plunging goitre; or they may be entirely intra-thoracic, and not palpable in the neck at all, although they are connected by a vascular or fibrous pedicle to the thyroid gland.

Rarely a goitre is found in the chest without any connection at all with the thyroid gland in the neck; this is the aberrant intra-thoracic goitre. These aberrant goitres may grow to a very large size. They are usually anterior in position and often lie on the left side.

The intra-thoracic goitres are usually adenomatous swellings and but rarely are associated with hyperthyroidism.

The retro-sternal goitre and the plunging goitre if large enough, may cause a shadow in the mediastinum; the intra-thoracic and aberrant goitre always do and, as there is little or no clinical evidence that they are associated with the thyroid gland, they present for diagnosis as mediastinal tumours.

The aberrant goitres have nothing to suggest their origin but many of the patients have had enlargements of the thyroid gland in the neck as well. Thyroid tissue in teratomata is not to be confused with these aberrant goitres.

Intra-thoracic goitres are not found very often. There were only 128 such in 17,600 thyroid operations performed by various surgeons — an incidence of .7 per cent. (Wakeley and Mulvany, 1940; Hunt, 1939; Pemberton, 1921; and Crile, 1939).

They are usually anterior or antero-lateral in position. They displace the innominate

veins downwards and backwards and compress the vena cava. They displace the trachea and oesophagus posteriorly and to one side. The trachea may be compressed and flattened by pressure from these goitres.

Pressure on these structures produces symptoms such as dyspnoea, stridor occasionally, dysphagia rarely, and engorgment of the veins of the neck and face. All these symptoms are aggravated when the patient bends over, turns the head or when he lies flat in bed. There may be alterations in the voice from pressure on the recurrent nerves.

The tumours arise from the lower poles of the thyroid lobes or rarely from the isthmus; they move, therefore, with the thyroid gland. They derive all their blood supply from the thyroid vessels and their only connection with any vessel in the chest is by a deep thyroid vein which empties into the left innominate vein.

Radiologically these tumours are in the anterior superior mediastium. The trachea may be flattened and is displaced to one side and posteriorly. The oesophagus may be displaced to the opposite side. There may be areas of calcification in the mass which moves when the patient swallows or coughs.

Laryngoscopy may show alterations in the cords. The diagnosis depends on the characteristic movement of the swelling as seen radiologically. There may be enlargement of the cervical thyroid or absence of the thyroid gland on the side concerned.

The treatment of these goitres is surgical removal which is almost always possible by a cervical approach. The vascular attachments of the thyroid are divided and the gland is freed from the trachea. The intrathoracic portion is then freed from its surroundings by a finger. If the goitre cannot then be pulled up into the neck, its capsule is opened and some of the contents removed. The goitre can then be delivered and removed. If the aperture of the thorax is too narrow even for this then the sternum must be split.

Although most of these intra-thoracic goitres are anterior nevertheless they may be posterior. These posterior glands do not appear to have attracted very much attention from surgeons as there is only a very scanty literature on them. Mora *et alii* could find only five cases in 1944 when they reported a sixth. Sweet, in 1949, however, reported six personal cases which suggests that the incidence is greater than would appear from Mora's six cases. Since then Keynes (1950) has reported two cases and Tomkinson (1951) three more and we have two cases to report. Thus, since 1939, there are 19 cases for survey. Of these 19 the side on which the goitre occurred was mentioned in 15 and no less than 14 were on the right side. In the remaining case on the left side the X-ray shows this to have been less posterior than the others in that the shadow of the goitre was over the trachea in the lateral projection rather than behind the trachea.

These goitres produce symptoms similar to those of the anterior variety but dysphagia occurs in about half of them, cough is common and some degree of thyrotoxicosis is present in about one-third.

In eight of thirteen cases the thyroid gland was not palpable in the neck and in two of the other five no thyroid lobe was palpable on the side of the intra-thoracic goitre. Those which were accompanied by cervical thyroids arose from the posterior aspect of the thyroid and in the others there was a long leash of vessels which extended into the thorax on that side. Sometimes the intrathoracic portion was connected to the cervical portion by a thin fibrous band.

The average age of the patients was 50 and thirteen of sixteen patients were females. These goitres are found posterior to the great vessels and posterior to the trachea which is pushed against the sternum at the sternal notch; this no doubt produces irritation and cough. They then lie against the bodies of the upper thoracic vertebrae, very often against the lateral aspects of the bodies. The oesophagus is displaced to the opposite side; but the trachea is usually in the mid-line. In our second case the oesophagus was displaced to the right by the plunging goitre and to the left below this by the intrathoracic goitre. If the goitre is large and on the right side the vagus may be stretched over it, with resultant gastric symptoms, as in one of Mora's cases and in our first case.

If the inlet of the thorax is large these goitres are easily removed from the neck. But if the thoracic inlet is small, if the mediastinal portion is large and extends well down into the thorax or if there is any doubt as to the nature of the mediastinal swelling, either the sternum must be split or approach made by a posterior thoracotomy.

In the second case the only difficulty is the control of the pedicle. If there is a goitre in the neck the inlet of the thorax is almost certain to be large enough to permit of approach through a collar incision. It follows therefore, that those subjected to posterior thoracotomy will have a small pedicle and it can be secured easily either because the tumour is soft or by reduction of the size of the tumour in the same way as is done in the cervical approach.

Case 17.

A married woman, aged 40, was admitted on 12th March, 1950. She had had a small lump on the left side of her neck for two years. For the previous year she had had a brassy non-productive cough, dyspnoea on exertion and had noticed distension of veins over the upper part of her chest and right breast. There had been no loss of weight. Five years previously she had had pneumonia and, until one year ago, productive cough and frequent colds.

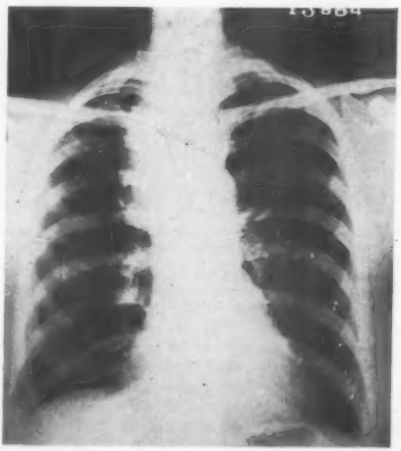

FIG. XXVIII. Case 17. Postero-anterior X-ray. Posterior intra-thoracic goitre. The midline position of the trachea is shown by the catheter.

On examination, she was well developed. Her face was slightly dusky and congested; her pupils were equal. There was a large vein half an inch in diameter which ran into her neck from her right breast. The trachea was in the midline. There was a small nodule in the left lobe of the thyroid gland which was not enlarged. The right lobe of the thyroid was palpable but not enlarged.

With her head fully extended she was unable to swallow easily as the movements of her larynx seemed somewhat restricted. Her blood pressure was 190/100 mm. of mercury. She had an increased aortic second sound. Her heart and lungs were otherwise normal. Her haemoglobin was 90 per cent.

Radiological study revealed a mass in the right superior mediastinum posterior to the trachea which was midline in position but displaced anteriorly.

Fluoroscopy (barium swallow) showed that there was a small diverticulum on the right anterior aspect of the oesophagus which was displaced to the left side. At bronchoscopy the trachea was found to be distorted and the anterior wall was a little flattened. Oesophagoscopy revealed there was no lesion in the lumen of the oesophagus which was somewhat distorted by pressure from without.

FIG. XXIX. Case 17. Lateral X-ray. Posterior intra-thoracic goitre. Note the posterior position of the tumour and the anterior displacement of the trachea. Catheter *in situ*.

A diagnosis of thyroid adenoma was made but in view of the diverticulum of the oesophagus and the deep extension of the tumour into the thorax a posterior approach was used.

Under pentothal, curare and endotracheal cyclopropane anaesthesia the 4th and 5th ribs were resected posteriorly. The pleura was opened and a large, firm mass 5 inches by 2½ inches was found in the posterior mediastinum to the right of the superior vena cava, which was stretched over its antero-medial aspect. The vagus nerve was also stretched over this aspect of the tumour which extended down to and filled the angle between the trachea and right main bronchus. Above, it

extended behind the trachea and displaced the oesophagus slightly to the left. The mass was solid and lobulated and easily separated except at the upper pole where there was a pedicle. Portion of the lobulated tumour was removed and the pedicle which was flat and strap like was secured. There was a small attachment to the wall of the oesophagus which was thus pulled out slightly. No definite diverticulum was seen. The pedicle, which was about an inch long, extended through the superior aperture of the thorax to the posterior portion of the right lobe of the thyroid. The superior aperture of the thorax was too narrow to permit easy passage of a forefinger. It would therefore have been difficult, if not impossible, to remove this tumour from the neck. The pleura over the bed of the tumour was closed.

FIG. XXX. Case 17. Right oblique X-ray. Posterior intra-thoracic goitre with barium in oesophagus. Note the small diverticulum near the upper margin of the tumour.

Pathological examination showed that the tumour was an adenoma of the thyroid of the foetal type.

The post-operative course was uneventful. The chest was aspirated on two occasions and 13 cc. of dark blood removed from the tumour bed at the first occasion and nothing at the second.

The distended vein over the right side of the chest was no longer visible. Her face lost its dusky hue and congested appearance. The adenoma in the left lobe appeared to be higher in the neck and was more mobile. She was able to swallow with ease with her head extended.

She remains well one year later and is symptom-free (Figs. XXVIII, XXIX, and XXX).

Case 18.

The patient, a woman of 63 years, with seven children, had for one year suffered from dizziness, breathlessness, and pain in the left chest which radiated to the right chest and up into her jaws. She had lost 2-3 pounds weight. Her symptoms were aggravated when she bent down or when she turned her head quickly.

For four to five months she had had some difficulty in swallowing liquids and they were liable to regurgitate. She had no difficulty with solid food. She had not noticed any swelling of her face at any time. She had had a cough for years.

On examination, she was an apprehensive woman with very slight congestion of her face and there were well-marked veins in the right side of her chest anteriorly. There was a small oval swelling on the right side of the neck posteriorly resembling an enlarged lymph node. Her pupils were equal and reacted to light and on convergence. The left lobe of the thyroid gland could just be palpated above the sternum on the left side. This portion was a small segment of a rounded swelling and when she coughed this portion and a large rounded tumour about 3 inches in diameter rose out of the thorax into the neck. On the right side of the neck no thyroid structure at all could be palpated. No tumour was visible in the neck except when she coughed and it returned at once to the thorax.

FIG. XXXI. Case 18. Postero-anterior X-ray. Posterior and anterior intra-thoracic goitres with barium in the oesophagus. Note displacement of the oesophagus to the right by the left lobe of the thyroid; and to the left by the right intra-thoracic goitre.

Radiological study showed that there was a large rounded tumour, which moved on swallowing, in the left anterior mediastinum. There was a shadow on the right side of the mediastinum which also moved on swallowing but not to the same extent. This shadow lay posteriorly and there was some calcification in it. The oesophagus was displaced first to the right side and then, lower down, to the left side. The trachea was slightly displaced to the right and anteriorly. Her basal metabolic rate was plus 38; her blood cholesterol was 176 milligrams per cent.

It was believed before operation that, although there were probably two tumours, possibly the whole appearance could be produced by the large tumour on the left side.

At operation under endotracheal anaesthesia a cervical approach was made through the ordinary collar incision.

FIG. XXXII. Case 18. Lateral X-ray. Posterior and anterior intra-thoracic goitres. Note anterior displacement of the trachea. The left-sided goitre can be seen overlapping the trachea. The calcification in the right lobe is just visible.

Under anaesthesia only the upper pole of the swelling on the left lobe of the gland could be palpated. When the skin was retracted it was seen that the pre-tracheal muscles were separated by the trachea which was placed very anteriorly. After division of the fascia a finger could be passed down alongside the trachea on the right side and a hard tumour could be felt extending posteriorly to the trachea. The trachea was immediately under the sternum and the posterior edge of the sternal notch was sharper than usual and touching the trachea. The vascular connections of the left lobe were divided and the tumour easily withdrawn into the neck. It measured 3½ inches by 2 inches by 2½ inches, with a constriction across the lower end. Below the constriction there was a cyst 1 inch in diameter. The portion which presented in the neck on coughing was about the upper half of the tumour. The tumour consisted almost entirely of a large adenoma with a cyst at its lower pole. The left lobe of the thyroid was present as a small piece of tissue at the apex of the tumour which arose from the posterior aspect of the lobe. A very small isthmus, about ⅛ inch in diameter, was present extending across the trachea. After removal of the left lobe the right lobe could just be seen in the thoracic opening. It had a long vascular pedicle entering its upper pole. This attachment was divided and the tumour partially freed. It was then pulled up and some vascular attachments, which appeared to come from the superior thyroid artery and enter the medial side of the lobe, were divided. There was a large vein running down from the superior pole of the thyroid into the thorax. This was divided and the tumour could then be pulled up well into the neck and the finger could just be passed around the lower pole of the tumour which was calcified. After this had been freed the tumour was easily delivered and removed. The tumour arose from the posterior aspect of a very small lobe of thyroid gland. On the left side the cavity extended into the mediastium and the great vessels were in the lower and posterior aspect of the cavity which extended down to the arch of the aorta. On the right side the cavity was bounded anteriorly by the right innominate artery and its branches. The tumour was entirely posterior to these arteries; it was entirely posterior to the trachea. The medial aspect of the cavity was formed by the lateral aspects of the bodies of the first, second and third thoracic vertebrae. The wound was closed with drainage.

Thus, in this patient, there was a left-sided plunging goitre with a permanently intra-thoracic but anterior portion. The right lobe was entirely intra-thoracic and from its posterior aspect there arose an irregularly shaped partially calcified adenoma which extended down to the lower border of the third thoracic vertebra and was posterior in position.

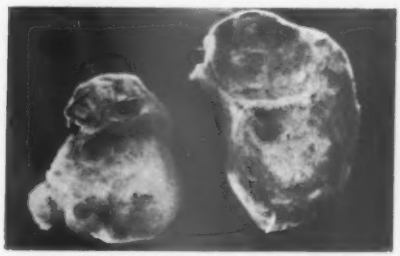

FIG. XXXIII. Case 18. Photograph of the small right and larger left lobe of the thyroid. The right lobe was entirely intra-thoracic. The left lobe was intra-thoracic below the upper groove. The tiny isthmus of the gland is visible on the medial side of the left lobe near the upper groove.

The right lobe of the thyroid weighed 39 grammes and the left 74.4 grammes (Figs. XXXI, XXXII and XXXIII).

PARATHYROID TUMOURS.

Parathyroid tumours may be found in either the anterior or posterior mediastinum. They are rarely visible on radiological examination and their presence is deduced by the absence of a parathyroid gland from its common habitat in the neck in a patient whose clinical condition indicates the presence of a parathyroid tumour. Cope (1941)

has pointed out that if an upper parathyroid is missing the most likely place for it is in the posterior mediastinum. If a lower one then it may be in either anterior or posterior mediastinum and often closely related to the thymus.

LIPOMATA.

Mediastinal lipomata are not common tumours and, in 1947, Smart and Thompson could find only 39 and added three of their own. Blades saw four lipomata in his 94 tumours of the mediastinum, and Bradford 3 in his.

Three varieties have been described, those entirely intra-thoracic, dumb-bell tumours in which a portion of the tumour inside the thorax communicates through an intercostal space with portion outside, and those in which the mediastinal tumour extends into the neck. The tumours may be very large indeed and usually cause pressure symptoms.

The radiological shadow of these tumours may be less opaque towards the periphery and for this reason Heuer and Andrus (1940) were able to predict the true nature of a mediastinal lipoma on two occasions.

Treatment should be removal.

We have one lipoma which, although it apparently began in the abdomen, eventually caused very severe symptoms by reason of a large intra-thoracic mediastinal portion of the tumour.

Case 19.

A female, aged 38, admitted in March, 1948, had a child in 1940. In 1943 she noticed onset of lassitude and a large abdominal tumour was found on the left side. Five attempts at removal were made but none was complete. By 1946 the tumour was found to have extended to the left sub-diaphragmatic area and again a partial removal was done. Since that time she had suffered with increasing dyspnoea, not influenced by posture. She had a cough and some flatulence. She had had oedema of the feet for one year.

On examination she was emaciated and her fingers were clubbed. Her heart was displaced to the right as was her trachea. Her blood pressure was 115/90 mm. of mercury. The breath sounds were absent in the left side of the chest, which was dull on percussion.

She had a large tumour in the left side of the abdomen.

Radiological examination in March, 1948, showed almost total opacity of the left side of the chest indistinguishable from fluid.

At operation, 22 lbs. of retro-peritoneal fatty tumour was removed. A further mass extended into the thorax. Microscopically the tumour, as on previous examinations, appeared to be a simple lipoma.

She was readmitted in June. She had become progressively more dyspnoeic until now she was very distressed.

She was emaciated; there was oedema of her feet. Her blood pressure was 155/115 mm. of mercury. The signs in her chest were more gross and she had a large left-sided abdominal tumour. Her liver was palpable for one fingers breadth.

FIG. XXXIV. Case 19. Postero-anterior X-ray. Lipoma of the abdomen and chest. Extreme displacement of mediastinal structures to the right.

Radiological examination showed a large opacity in the left side of the thorax which extended up to the 5th rib posteriorly. The heart was displaced so that its right border overlapped the anterior end of the 5th right rib. The trachea was displaced over the anterior ends of the first three ribs. The tumour had grown considerably since the radiological examination in March, 1948.

After one week's stay in hospital she developed an acute obstruction of the small bowel by an adhesion to the posterior abdominal wall. She died eighteen days later.

At post-mortem, a large retro-peritoneal and retro-pleural tumour extended from the brim of the pelvis to the 4th thoracic vertebra. It weighed 16 lbs. and could be shelled out.

The histological report was that one portion of the tumour showed myxo-fibro-lipoma, and another portion mixed-cell, giant-cell sarcoma (Fig. XXXIV).

HAEMANGIOMATA.

Haemangiomata and haemangio-endotheliomata are among the less common of the mediastinal tumours and Seybold, McDonald, Clagett, and Harrington (1949) described three which they had seen among 200 mediastinal tumours and, in an incomplete review of the literature, found 14 more. Thomas and Chesser (1950) have since added another and we have one such case to report. In 10 of the 19 cases there was some evidence of malignancy. There may be multiple tumours and in Seybold's paper it is suggested that these are multiple primary rather than metastatic lesions. In Thomas' case the tumour was discovered by mass survey but the patient had mild pressure symptoms. The tumour was benign and encapsulated.

The tumours may present in the neck. Though often encapsulated, when malignant they invade other structures. They may be anterior or posterior in position. Seven of the 19 tumours were removed surgically. Treatment therefore should be surgical removal if possible.

Case 20.

The patient was a female infant aged 3 months admitted to hospital on 5th Feb., 1946. She had a lump in the right side of her neck which had been getting larger recently.

On examination, there was a soft swelling in the right side of the neck above the clavicle. The swelling bulged on expiration; there was some respiratory distress which was aggravated when the swelling was reduced by pressure. The mediastinum appeared to be displaced to the right.

Radiological examination three days later demonstrated a soft tissue swelling in the right side of the neck of about the same density as fat; it contained neither air nor lung tissue. The mediastinum was displaced to the right; there was a formless shadow across the left side of the chest. A diagnosis was made of neoplasm of the mediastinum involving the neck and as the child's condition had deteriorated operation was advised. She had considerable respiratory embarrassment which was aggravated at meal-times and she had some cyanosis. The swelling in the neck was aspirated and 2 ounces of blood-stained fluid obtained.

On 13th Feb. an artificial pneumothorax was induced with 120 cc. of air on the right side and the pressures were then −4 +8 cm. water. The swelling in the neck was aspirated and 2 ounces of blood-stained fluid obtained.

FIG. XXXV. Case 20. Haemangioma of the mediastinum and neck. Photograph of the posterior aspect of the mediastinal structures. The left lung is still *in situ*, the upper of the two tumours is the one which presented in the neck. The subclavian artery is just visible over it. The lower and larger tumour was well anterior and the right lung has been removed to display it.

Next day a right thoracotomy was performed through the 3rd intercostal space under local anaesthesia. A multi-locular extra-pleural cystic mass was found in the anterior mediastinum. The cysts appeared to be part of the mass in the neck. Two cysts were aspirated. The others did not collapse. The cysts contained blood-stained fluid. The chest was closed without drainage. On microscopic examination of the fluid only blood cells were seen.

The child's distress seemed to be relieved by the operation and the swelling in the neck was aspirated on two occasions, 3 cc. and 17 cc. of fluid were obtained.

Deep X-ray therapy was begun on 20th Feb., 1946. The improvement was maintained until seven days later when she developed a pyrexia of 103° with some cough and sputum and she began to lose weight. She then remained stabilized for a few weeks and radiologically the mediastinal tumour appeared to be smaller. She was less distressed.

At the end of March the swelling in the neck and that in the mediastinum were increasing in size; by 15th Apr. her respiratory distress had increased and she had had several attacks of cyanosis. The swelling in the neck was larger. It was aspirated and 50 cc. of fluid were withdrawn. The aspirations were repeated but her condition progressively deteriorated and she died of respiratory embarrassment on 29th April.

At post-mortem examination the body was undernourished. In the right side of the neck there was a cystic mass which consisted of several very large loculi which appeared to arise from the region of the apex of the pleura and extended upwards, backwards and forwards. The subclavian artery arched over the upper aspect of the mass which extended down in the anterior mediastinum as far as the bifurcation of the trachea.

In the right side of the mediastinum there was a large mass, separate from that in the neck, which consisted of several large loculi and contained blood. It was separate from, but in front of, the pericardium, thymus and great vessels. It measured 3 x 1½ x 1½ inches. The structure of the mass in the neck resembled that of the mediastinum. The lungs were not collapsed; the liver was normal. There was no other relevant data. On microscopic examination the tumour was a haemangioma consisting of vascular spaces in a spindle cell matrix (Fig. XXXV).

LYMPHANGIOMATA.

Lymphangiomatous cysts have been seen in the mediastinum and eight such cysts, also called cystic hygromata of the mediastinum, were reported by Harley and Drew (1950). Most of them were symptom free and were found on radiological examination. They are usually in the anterior mediastinum but have been recorded in the posterior mediastinum. They may extend into the neck in a dumb-bell fashion (Swift, 1946). Six were multi-locular and there were no details on the remainder. Six patients were under 33 and three were young children. Excision is the treatment of choice.

We have one cyst found at post-mortem examination in which the histological appearances conform with the diagnosis of lymphangiomatous cyst.

Case 21.

A male, 64 years old, had been admitted to hospital several times for renal calculi with infection. He also had Paget's disease of bone. His final admission was for uraemia. He had had a cough for one week; he was not breathless. He died eight days later with anuria.

At post-mortem examination a firm white cystic tumour measuring 4 x 2½ x 2 inches was found in the right side of the posterior mediastinum lying against the vertebral column. It was easily dissected from the surrounding structures. The wall was ¼ inch thick. The contents were brown, firm, homogeneous material.

Histological examination showed the wall to contain much fibrous tissue in laminae with several clumps of lymphocytes. There were numerous distended vessels with syncytial linings. There were many small spaces throughout the tissue, and occasional areas of calcification. The whole appearance was suggestive of faulty lymphatic development and the structure was probably a lymph cyst.

FIBROMATA.

Clagett and Hausmann (1944) describe a very large fibroma which was in the posterior mediastinum, but no definite origin either from the mediastinum or chest wall could be determined.

These tumours are very rare and Blades (1946), in 94 cases of mediastinal tumour, had only one fibroma, and that he thought was probably a neuro-fibroma. Heuer and Andrus (1940) found only 32 cases and of these some may have been neurofibromata. Harrington's case of a benign fibroma with a blood-stained effusion is of interest. The tumours may be very large and cause pressure symptoms. They may become malignant. Treatment is removal if possible.

MALIGNANT TUMOURS OF THE MEDIASTINUM.

The malignant tumours of the mediastinum, excluding malignant varieties of those already discussed, are tumours which arise in the reticulo-endothelial system — the reticulo-sarcomata or lymphomata which include lymphosarcoma and Hodgkin's disease. These tumours, although they may occur as solitary tumours of the mediastinum, more usually extend into the neck and portion of the tumour can be felt there. As they arise in the lymph nodes the tumours are found in the mediastinum along the trachea and often in front of it. They cause pressure early and may run a very rapid course.

They are radio-sensitive and when a tumour is believed to belong to this group radiotherapy may be tried for a month. If no change is size occurs, thoracotomy should be done for diagnosis and treatment, unless diagnosis is possible by other means. There may be involvement of the other lymph nodes and an abnormal blood count.

Blades, in his series of 94 tumours, found 14 malignant tumours of which 6 were in this group, four of the Hodgkin's variety. Eight of the tumours were malignant teratomata, etc.

Case 22.

The patient was a woman aged 33 with four children, the youngest aged two. She had noticed for six weeks that when she squared her shoulders or stooped she felt as if the blood rushed up into her neck veins and there was buzzing in her ears and in her head. Shortly after this the veins began to stand out in her neck; she was breathless on sweeping or going up stairs and she felt that she could not get enough air. She had a dull ache between her shoulders, worse when lying down, and she noticed that her face swelled at night. She had lost a little weight; her appetite was poor. She had very slight difficulty in swallowing. All her symptoms were worse when she was tired. Her periods were regular and the last a fortnight previously.

The blood count was normal; the Wassermann reaction negative; and the blood sedimentation rate 6 mm. per hour (Cutler method).

On examination she looked healthy except that there was some congestion in her face and slight puffiness of her face and eyes when she bent down. The veins of her neck became enlarged and tense on both sides of the neck when she braced her shoulders or bent over. There was a hard, firmly fixed node in the right side of the neck immediately above the clavicle. There was increased vocal fremitus posteriorly to the right of the midline about the level of the 6th to the 8th thoracic vertebra. There were a few palpable nodes in the right axilla. The spleen was not palpable. There were no other relevant signs.

FIG. XXXVI. Case 22. Postero-anterior X-ray. Hodgkin's disease. Note bilateral shadow.

Radiological studies showed a shadow with well-defined edge to the right of the midline in the superior mediastinum and placed just in front of the trachea. The mass did not move on swallowing. A diagnosis was made of a malignant growth of the reticulo-sarcoma variety and a course of deep X-ray therapy over 29 days was given. After this the shadow in the mediastinum disappeared, the swelling in the neck could not be felt but there was a small node palpable just above the left clavicle. All her symptoms had disappeared except that she sometimes noticed a large vein on the right side of the neck after effort.

She died three weeks later with a recurrence of symptoms lasting a few days. A section of a node showed that the tumour resembled Hodgkin's disease (Fig. XXXVI).

Secondary carcinoma is often seen in the nodes of the mediastinum and, as the minute carcinoma of the lung was often overlooked, oat-celled carcinoma of the lung was for a long time believed to be a primary carcinoma of the mediastinum.

There is yet another malignant tumour which must be considered with this group. This is the Pancoast or superior sulcus tumour.

This tumour is a malignant one which grows as its name suggests in the apex of the thoracic cavity. It involves the ribs early and invades the soft tissues of the chest wall superficial to the ribs. It produces pressure on the cervical sympathetic nerves, on the first dorsal and other intercostal nerves, and may invade the vertebral column and cause pressure on the cord.

It grows rapidly. The chief symptom is pain, which may be very severe due to bone erosion or nerve pressure. The pain may radiate into the face, the arm or the shoulder. There may be lancinating pain, in episodes. Horner's syndrome is often present on the same side. There may be wasting of the small muscles of the hand.

Radiologically these tumours present as tumours of the superior posterior part of the mediastinum with erosion of the first three ribs, and cannot in the early stages be differentiated from the neurogenic tumours in this region or the pleural sequestration cysts.

It seems likely that the original group of tumours described by Pancoast included some which had arisen in the apex of the lung, some which were metastatic in their origin and some which did not arise from the pleura or lung. Only adequate post-mortem examination can determine the exact origin. There are, it seems, at least two varieties of this tumour, an intra-pulmonary and an extra-pulmonary of which the former occurs more frequently.

Fried (1945) describes two cases (numbers 32 and 33) in which post-mortem examination showed that the tumours were completely separated from the lung by the pleura. In these cases the tumours were squamous-cell carcinomata. He suggests that they arose in remnants of the 5th branchial arch and that they are therefore branchiogenic carcinomata.

This tumour is one of the most psychologically depressing by reason of the intensity and persistence of the pain. Despite the numerous physical signs produced in the fully developed syndrome the patients are seldom seen at a stage in which active treatment is possible. Radiotherapy is of little value.

In 134 (? 151) collected cases Herbut found Horner's syndrome in 133, destruction of ribs in 72, and vertebrae in 41. In 129 there was pain in the shoulder, in 20 oedema of the arm, and in 99 loss of power in the arm. Forty-eight patients complained of cough and 6 had haemoptysis. There were 137 males and 14 females. The average length of the disease until death was 10.5 months. (There seems to be a misprint in these figures as quoted by Fried.)

Case 23.

A male, aged 50, seven weeks previously, had developed a heavy cold and a cough with pain in the right shoulder and the right shoulder blade going across the back into the left shoulder blade. He had a chafed feeling under both arm pits. His cold and cough then disappeared and he had no other symptoms but had lost a stone in weight. Six years previously he had had thyroidectomy for adenoma of the thyroid.

On examination his general condition was good. There was slight wasting of the hypothenar muscles of the right hand but no alteration in sensation. There was slightly diminished air entry at the right apex posteriorly with slight diminution of vocal resonance; occasional rhonchi were heard in this area. His pupils were equal and regular and reacted to light and on convergence.

Radiological studies showed a dense shadow in the upper and posterior part of the right thorax. It had a rounded clear-cut lower margin and extended down as low as the 6th rib posteriorly. There was slight erosion of the 3rd rib. Bronchograms showed that the lung was compressed by the tumour. A diagnosis of neurogenic tumour was made.

FIG. XXXVII. Case 23. Postero-anterior X-ray. Superior sulcus tumour at right apex. Note rounded lower margin. Erosion of the 3rd rib is just visible.

His pain became worse; he developed a Horner's syndrome on the right side, the tumour rapidly advanced and seven weeks after he was first seen he died. In the week previous to death he developed evidence of cord pressure and finally paraplegia. There was gross erosion of the third rib and there seemed to be some fulness in the back of the chest in the region of the tumour.

Post-mortem examination was refused but a piece of the tumour was obtained for section. It had extended through the ribs and had invaded the soft tissues and thence the spinous processes of the adjacent vertebrae. The tumour was necrotic in its central portion and obviously malignant.

FIG. XXXVIII. Case 23. Right oblique bronchogram. Superior sulcus tumour.

Histological examination showed aggregates of round cells bounded by a layer of round cells almost like a basement membrane. The aggregates were set in a stroma of young connective tissue. The picture is one of a highly malignant tumour of doubtful origin (Figs. XXXVII, XXXVIII and XXXIX).

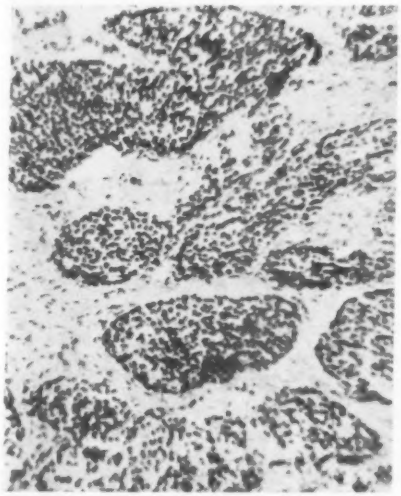

FIG. XXXIX. Case 23. Superior sulcus syndrome. Photomicrograph of specimen showing aggregates of round cells with pseudo-basement membrane. (x 90.)

INFLAMMATORY TUMOURS.

Parasitic cysts due to the echinococcus may occur in the mediastinum but are by no means common. The diagnosis can only be made by macroscopic or histological examination of a cyst or its contents. However, the diagnosis is suggested when a rounded shadow is seen in the mediastinum in a patient known to be infected with hydatids.

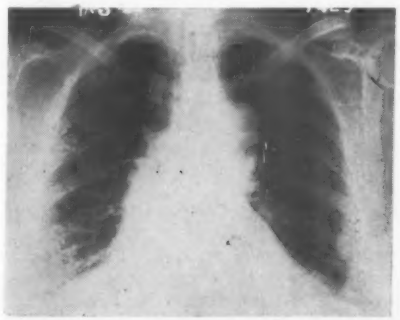

FIG. XL. Case 24. Postero-anterior X-ray. Hydatid of mediastinum. Rounded shadow just below the aortic knuckle.

Case 24.

A female, aged 50, had had operations for hydatids in the liver and for a recurrence in the incision twenty-five and fifteen years ago respectively. Six years previously she had been told she had dead hydatids in the liver. Recently she had developed pain in the right side of her back. She had a cough and occasionally some haemoptysis. She had coughed up some material, which she described as grape skins, intermittently for seven to eight months.

Radiological study showed two cysts in the liver, one of which extended well upwards into the right chest anteriorly. On the left side just below the arch of the aorta there was a rounded shadow.

This patient refused operation so there is no proof that this rounded shadow was an hydatid cyst (Fig. XL).

FIG. XLI. Postero-anterior X-ray. Enlarged thymus of infancy.

A series of eight tumours of the mediastinum which may be tuberculomata was described by Samson, Heaton and Dugan in 1950. The series included the original case of Grace (1942). Tubercle bacilli were found in only one case. The lesions in all cases but one contained lymphoid tissue which suggests they are a granulomatous process in lymph nodes. They were all in close association with the trachea or bronchi as would be expected if they arose in the tracheo-bronchial lymph nodes. They were very adherent to surrounding structures such as vessels and nerves. Surgical

removal has been hazardous and has involved injury to the pulmonary artery and vena cava and to the phrenic and vagus nerves. There was no evidence of pulmonary tuberculosis in any of the cases. Acid fast organisms were found in only one of the tumours.

The consensus of opinion in the discussion of this paper and the opinion expressed by Graham (1950) in the "Yearbook of General Surgery" is that if a diagnosis can be made, these tumours should be treated conservatively. However, there is no good way of diagnosis except by examination of the tumour when removed.

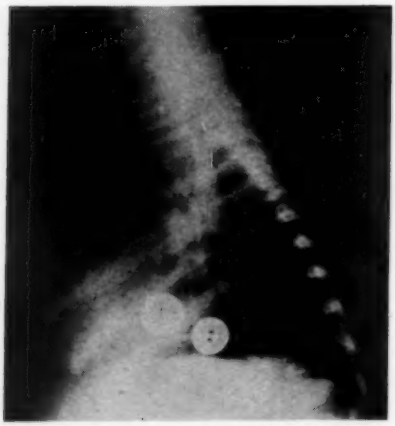

FIG. XLII. Lateral X-ray. Enlarged thymus of infancy. Note angulation of the trachea at the hilum.

Tuberculous cold abscesses in association with disease of the vertebrae are commonly seen in the posterior mediastinum. Their characteristic spindle shape together with the associated spinal disease should prevent any difficulty in diagnosis.

Gumma has been described by Piazzi-Martinni (1914).

SUMMARY.

Twenty-four cases of tumours and cysts of the mediastinum are described, and include two cases of posterior mediastinal goitre, 1 haemangioma, and 1 lymphatic cyst.

A survey of the literature of some 600 tumours and cysts has been made.

A brief description of the various types of tumours and cysts is given.

ACKNOWLEDGEMENTS.

I wish to express my thanks to Professor Sutton, Dr. P. Earnshaw, Dr. Arden, Dr. Schafer and Dr. Patterson for permission to make use of their cases; to Professor Canny and Professor Wilkinson for their advice and help; to Dr. Pye and to the Matron of the Mater Misericordiae Hospital for permission to use their material, and to Mr. Thompson who made the photographs.

REFERENCES.

ABBOTT, O. A. (1948), *Dis. Chest*, vol. 14, page 824. Quoted by Brewer and Dolley.

ADAMS, R. and HOOVER, W. B. (1945), *J. Thoracic Surg.*, vol. 14, page 279.

ADAMS, W. E. and THORNTON, T. F. (1943), *J. Thoracic Surg.*, vol. 12, page 503.

ALLISON, P. R. (1947), *Thorax*, vol. 2, page 176.

ANDRUS, W. de W. (1940), *Surg. Gynec. Obst.*, vol. 71, page 528.

BECK, C. S. (1942), *Ann. Surg.*, vol. 116, page 161.

BERRY, F. B. (1950), *J. Thoracic Surg.*, vol. 19, page 768.

BLADES, B. (1946), *Ann. Surg.*, vol. 123, page 749.

BRADFORD, M. L., MAHON, H. W. and GROW, J. B. (1947), *Surg. Gynec. Obst.*, vol. 85, page 467.

BREWER, L. A. and DOLLEY, F. S. (1949), *Am. Rev. Tuberc.*, vol. 60, page 149.

BROWN, R. K. and ROBBINS, L. L. (1944), *J. Thoracic Surg.*, vol. 13, page 84.

BURNAM, C. F. (1917), *J. Amer. Med. Assoc.*, vol. 69, page 989. Quoted by Samson *et alii*.

CARLSON, H. A. (1943), *J. Thoracic Surg.*, vol. 12, page 376.

CLAGETT, O. T. and HAUSMANN, P. F. (1944), *J. Thoracic Surg.*, vol. 13, page 6.

COPE, O. (1941), *Ann. Surg.*, vol. 114, page 707.

COPE, Z. (1939), "Pioneers in Acute Abdominal Surgery," London, Oxford Medical Publication, page 104.

COWLEY, R. A., SLOAN, H. E. and SULLENBERGER, N. H. (1951), *J. Thoracic Surg.*, vol. 21, page 159.

CRILE, G., jr. (1939), *Cleveland Clin. Quart.*, vol. 6, page 313, quoted by Mora.

CURRERI, A. R. and GALE, J. W. (1941), *Ann. Surg.*, vol. 113, page 1086.

CUTLER, E. C. and GROSS, R. E. (1936), *Ann. Surg.*, vol. 104, page 436.

D'ABREU, A. L. (1937), *Brit. J. Surg.*, vol. 25, page 317.

DORAN, W. T. and LESTER, C. W. (1939), *J. Thoracic Surg.*, vol. 8, page 309.

DRASH, E. C. and HYER, H. J. (1950), *J. Thoracic Surg.*, vol. 19, page 755.

EDWARDS, A. Tudor (1927), *Brit. J. Surg.*, vol. 14, page 607.

FREEDLANDER, S. O. and GEBAUER, P. W. (1939), *J. Thoracic Surg.*, vol. 8, page 581.

FRIED, B. M. (1948), "Bronchiogenic Carcinoma and Adenoma." Baltimore, The Williams and Wilkins Company, page 181.

GANS, S. L. and POTTS, W. J. (1951), *J. Thoracic Surg.*, vol. 21, page 313.

GEBAUER, P. W. (1943), *J. Thoracic Surg.*, vol. 12, page 458.

GLEDHILL, E. Y. and MORROW, A. G. (1950), *J. Thoracic Surg.*, vol. 20, page 923.

GODWIN, J. T., WATSON, W. L., POOL, J. L., CAHAN, W. G. and NARDIELLO, V. A. (1950), *J. Thoracic Surg.*, vol. 20, page 169.

GRACE, A. J. (1942), *J. Thoracic Surg.*, vol. 12, page 131.

GRAHAM, E. A. (1950), "Year Book of General Surgery," page 202.

GREENFIELD, I., STEINBERG, I. and TOUROFF, A. S. W. (1943), *J. Thoracic Surg.*, vol. 12, page 495.

GUPTHILL, P. (1950), *J. Thoracic Surg.*, vol. 19, page 768.

HARDY, L. M. (1949), *Pediatrics*, vol. 4, page 108. Quoted by Graham "Year Book of Surgery," 1950, page 200.

HARLEY, H. R. S. and DREW, C. E. (1950), *Thorax*, vol. 5, page 105.

HARPER, F. R. (1939), *J. Thoracic Surg.*, vol. 9, page 132.

—— (1942), *J. Thoracic Surg.*, vol. 11, page 446.

HEUER, G. J. and ANDRUS, W. de W. (1940), *Am. J. Surg.*, vol. 50, page 143. Quoted by Kent.

HOCHBERG, L. A., GRIFFIN, E. H. and BICUNAS, A. (1950), *J. Thoracic Surg.*, vol. 20, page 315.

HUGHES, F. A. (1950), *J. Thoracic Surg.*, vol. 19, page 768.

HUNT, C. J. (1939), *Trans. West. Surg. Assoc.*, vol. 49, page 465. Quoted by Mora.

JAMES, A. G. and CURTIS, G. M. (1941), *Ann. Surg.*, vol. 113, page 767.

JANES, R. M. (1939), *J. Thoracic Surg.*, vol. 9, page 145.

KENT, E. M., BLADES, B., VALLE, A. R. and GRAHAM, E. A. (1944), *J. Thoracic Surg.*, vol. 13, page 116.

KEYNES, G. (1946), *Brit. J. Surg.*, vol. 33, page 201.

—— (1950), *Brit. Med. J.*, vol. 1, page 621.

KING, E. S. J. (1941), "Surgery of the Heart." London, Edward Arnold, page 703.

KISSNER, W. H. and REGANIS, J. C. (1950), *J. Thoracic Surg.*, vol. 19, page 779.

LADD, W. E. and SCOTT, H. W. (1944), *Surgery*, vol. 16, page 815.

LAIPPLY, T. C. (1945), *Arch. Path.*, vol. 19, page 153. Quoted by Blades.

LAMBERT, A. V. S. (1940), *J. Thoracic Surg.*, vol. 10, page 1.

LANZA, G. (1937), *Arch. per le Sc. Med.*, vol. 63, page 17. Quoted by Rusby.

LILLIE, W. I., MCDONALD, J. R., CLAGETT, O. T. (1950), *J. Thoracic Surg.*, vol. 20, page 494.

MCCORKLE, R. G., KOERTH, C. J. and DONALDSON, J. M. (1940), *J. Thoracic Surg.*, vol. 9, page 568.

MCDONALD, J. R., MOERSCH, H. J. and TINNEY, W. S. (1945), *J. Thoracic Surg.*, vol. 14, page 445.

MCDONALD, J. R. (1946), *Proc. Staff Meet. Mayo Clinic*, vol. 21, page 416.

MORA, J. M., ISAACS, H. J., SPENCER, S. H. and EDININ, L. (1944), *Surg. Gynec. Obst.*, vol. 79, page 314.

NICHOLSON, G. W. de P. (1950), "Studies on Tumor Formation." London, Butterworth and Coy., page 254.

O'NEAL, L. W. and ACKERMAN, L. V. (1951), *J. Thoracic Surg.*, vol. 21, page 71.

PEMBERTON, J. de J. (1921), *Arch. Surg.*, vol. 2, page 1. Quoted by Mora.

PHEMISTER, D. B., STEEN, W. B. and VOLDERAUER, J. C. (1936), *Am. J. Roentgenol*, vol. 36, page 14. Quoted by Rusby.

PIAZZI-MARTINNI, V. (1914), *Ann. di Clin. Med.*, vol. 5, page 173. Quoted by Burman.

POPPE, J. K. and DE OLIVERA, H. R. (1946), *J. Thoracic Surg.*, vol. 15, page 186.

POWER, Sir D'Arcy (1921), *Brit. J. Surg.*, vol. 9, page 27.

ROBB, D. and NICKS, R. (1950), "Report of the Thoracic Surgical Unit, Green Lane Hospital, Auckland, New Zealand."

RUSBY, N. L. (1944), *J. Thoracic Surg.*, vol. 13, page 169.

SAMSON, P. C., HEATON, L. D. and DUGAN, D. J. (1950), *J. Thoracic Surg.*, vol. 19, page 333.

SANES, S., MACMANUS, J. E. and SCATCHARD, G. N. (1945), *J. Thoracic Surg.*, vol. 14, page 253.

SCHAFFNER, V. D., SMITH, R. P. and TAYLOR, H. E. (1943), *J. Thoracic Surg.*, vol. 12, page 247.

SCHWARTZ, H. and WILLIAMS, C. S. (1943), *J. Thoracic Surg.*, vol. 12, page 117.

SEYBOLD, W. D., MCDONALD, J. R., CLAGETT, O. T. and GOOD, C. A. (1950), *J. Thoracic Surg.*, vol. 20, page 195.

SEYDE, G. N. (1938), *Frankfurt Z. Path.*, vol. 52, page 346.

SILVEUS, E. and ADAMS, R. (1947), *Surg. Clin. N. Amer.*, page 595.

SMART, J. and THOMPSON, V. C. (1947), *Thorax*, vol. 2, page 163.

STEELE, J. D. and SCHMITZ, J. (1945), *J. Thoracic Surg.*, vol. 14, page 403.

SWEET, R. H. (1949), *Surg. Gynec. Obst.*, vol. 89, page 57.

SWIFT, E. A. and NEUHOF, H. (1945), *J. Thoracic Surg.*, vol. 15, page 173.

TAYLOR, F. H. (1951), *J. Thoracic Surg.*, vol. 21, page 189.

TEMPLE, L. J. (1950), *J. Thoracic Surg.*, vol. 19, page 412.

THOMAS, N. K. and CHESSER, I. M. (1950), *J. Thoracic Surg.*, vol. 20, page 321.

TOMKINSON, J. S. (1951), *Brit. J. Surg.*, vol. 38, page 271.

THOMPSON, J. V. (1947), *Internat. Abstr. Surg.*, vol. 84, page 195.

WAKELEY, C. P. G. and MULVANY, J. H. (1940), *Surg. Gynec. Obst.*, vol. 70, page 702.

WATSON, W. L. and URBAN, J. A. (1944), *J. Thoracic Surg.*, vol. 13, page 16.

WILLIS, R. A. (1948), "Pathology of Tumors." London, Butterworth and Coy., pages 951, 980.

WRIGHT, A. D. (1936), *Brit. J. Surg.*, vol. 23, page 612.

ADDENDUM.

Two statements were omitted from the text of Part One. The first on page 38, column 2, should be read after: "These are the bronchogenic cysts"—They are also called aberrant lung cysts, paratracheal or para-oesophageal cysts.

The second, on page 39, column 2, should be read after: "Spring water cysts"—These cysts have thin transparent walls of fibrous tissue with many nuclei, whereas the pleural sequestration cysts have thicker opaque walls of fibrous tissue with scanty nuclei.

OSTEITIS PUBIS*

By Henry Mortensen.

St. Vincent's Hospital, Melbourne.

OSTEITIS pubis is a rarefying condition of bone arising as a complication of operations on the lower urinary tract. Possibly of recent origin and certainly of recent recognition, it was first described in the English language by Beer (1924) who stated "During the last dozen years following supra-pubic operations on the bladder, we have repeatedly observed a curious and painful condition of periostitis," and again, "It is surely a rare complication although we have seen every year one or more cases during the past twelve years." In the year prior to this Legeu and Rochet (1923) mentioned *l'osteite pubienne* as a complication of peri-vesical and pelvic cellulitis.

Incidence.

Prior to 1947 practically all cases were reported as occurring after the second stage of a two-stage supra-pubic prostatectomy. Since that date the cases presenting this complication have become more protean in their nature. As a result of my personal experience it was felt that the lesion was of more common occurrence than one believed from reading the literature. (Henderson (1950) quotes 64 cases from the literature with 5 case reports of his own.) A questionnaire was therefore addressed to the members of the Urological Society of Australasia and 44 cases were collected from the practices of 16 out of 37 urologists who returned answers. In these cases 5 occurred after cystectomy, either partial or complete, 29 after retro-pubic prostatectomy, 5 after supra-pubic prostatectomy, 3 after trans-urethral resection, one after external urethrotomy and one after rupture of the posterior urethra, all of these last five being associated with supra-pubic cystotomy.

Perhaps the main interest lies in the occurrence of osteitis pubis after the use of the retro-pubic route of approach to the prostate, as elaborated in recent years by Terence Millin. Though comparatively rare in the experience of the originator of the operation, his latest statistics being 9 cases in 1,100 retro-pubic prostatectomies (1950), its incidence in a high percentage of prostatectomies performed by this route has led various urologists to view the procedure with concern and in some instances to abandon it.

Table 1.

Cystectomy, partial or complete ..	5 cases
Retro-pubic prostatectomy	29 cases
Supra-pubic prostatectomy	5 cases
Trans-urethral prostatectomy	3 cases
External urethrotomy	1 case
Rupture of the prostate urethra ..	1 case
	44 cases

Moore (1949) has reported 8 cases occurring in the first 46 prostatectomies done by this method and, discussing the subject at a recent meeting of the American Urological Association (1950), stated that 13 out of his first 80 retro-pubic prostatectomies developed osteitis pubis. In the cases here presented it is noted that 65 per cent. followed on this operation, one urologist reporting the occurrence of 7 cases of osteitis pubis following on 165 cases of retro-pubic prostatectomy. In this series, apart from one case diagnosed in 1934, no case was seen prior to 1944.

Signs and Symptoms.

The clinical picture may be mild or severe, symptoms beginning from fourteen to twenty-eight days after the relative operation. Rarely the onset may be delayed for upwards of four months, as in one case in this series. The severe cases appear to be more common than the mild.

*Read at the Annual General Meeting, Sydney, June, 1951.

Clinically, pain is the outstanding symptom, beginning in the midline and associated with great tenderness on pressure over the symphyseal region. With extension of the disease to the rami of the pubes, pain is complained of in the inguinal regions on both sides and in the upper medial aspect of the thighs. Later the ischia become involved, with pain in the perineum and the buttocks. The muscles attached to the affected bones become spastic, any movement of the pelvis causing contractions which are excruciatingly painful. Micturition becomes painful, particularly at the end of the act, and because of the contraction of the *levatores ani* muscles and the use of the bed pan, defaecation becomes a misery. The most obvious spasm is that of the adductor muscles, and the patient lies in bed in gross fear of any movement. This is a pathognomonic picture hardly comparable with that seen with any condition in other parts of the body. The dramatic symptom complex may persist for many weeks or some months. With the passage of the hyper-acute stage the act of walking or sitting may be painful for as long as twelve months. In the milder cases the symptoms are far less severe and their duration much shorter.

FIG. I. The earliest changes of osteitis pubis with generalised rarefaction of the rami of the pubes, and some erosion of the upper portion of the symphyseal joint.

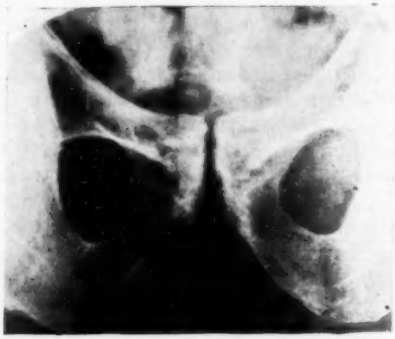

FIG. II. X-ray picture taken three weeks after Fig. I showing a gross involvement of the symphyseal joint and the adjacent bone, with earliest signs of periosteal lifting at the site of muscular attachments to the ischium.

X-RAY APPEARANCES.

The earliest radiological changes may be seen about the third week. They occur in the symphysis pubis, where a moth-eaten appearance of the pubes adjacent to the symphyseal cartilage is seen (Figs. I and II). The brunt of the disease at this state affects this joint, the cartilage disappearing and the pubic bones being splayed out for a distance of up to one and a half centimetres (Fig. III). With the progress of the disease, areas of rarefaction are seen in both rami of the pubes on each side and in the severe cases similar changes are noted in the ischia. Evidence of lifting and fraying of the periosteum is present, particularly in relationship to the muscular attachments (Fig. III). With retrogression recalcification takes place, even though symptoms may

FIG. III. Case No. 2. X-ray picture taken five weeks after onset of pain, showing classical appearance of osteitis pubis with marked splaying of the symphyseal joint and periosteal lifting of the ischium.

still be present (Fig. VI), and after a period of months complete bony restitution will occur. In the symphyseal region bony ankylosis ensues, whilst in the region of the muscular attachments large masses of bone will

FIG. IV. Case No. 2. Six months later, showing healed appearance of symphyseal joint, with marked osteophytic developments in the region of muscular attachments.

extend into the muscles, particularly the adductor group (Fig. IV). Abscess formation has been noted on occasion, but each of the recorded collections of pus has been very small, five to ten cubic centimetres. No

FIG. V. Case No. 3. X-ray picture taken six weeks after the development of symptoms.

abscess formation occurred in these 44 cases, nor was the presence of sequestra reported.

TREATMENT.

No treatment offers any certainty of either cure or amelioration of the symptoms. In the cases here recorded some relief of symptoms was obtained by chemotherapy in two cases, and in one rapid relief followed the exhibition of large doses of vitamin B. In all other cases the routine measures of chemotherapy, vitamin therapy, radiotherapy, diathermy and radiant heat were tried without significant result. Of the latest chemotherapeutic compounds, chloromycetin has been used by Hamm and Lavelle in 4 cases without encouraging results. Immobilisation and traction on the lower extremities has been tried without success. Marked improvement and eventual cure was obtained by the use of A.C.T.H. in cases recorded by Dean of New York, and Emerson Smith of Montreal (1950).

FIG. VI. Case No. 3. Healing appearance some three months later.

DISCUSSION.

Numerous theories have been advanced in explanation of the various unusual features of this disease.

(1) Osteitis pubis almost always follows on operations involving the opening of the bladder. Exceptions are recorded as following trans-urethral resection. In the 2 cases mentioned by Bruskewitz and Ewell (1949) both gave a history of severe bleeding in the anterior region of the bladder neck requiring an excessive degree of coagulation for haemostasis. In a female these observers record an unusual case following on the removal of a stone from the lower end of the ureter. In this present series all 3 of the cases of trans-urethral resection which

were followed by osteitis pubis required cystotomy in their after-care because of haemorrhage, extravasation and peri-vesical abscess respectively.

That the condition is related to the opening of the pre-vesical space is strongly suggested by the great number of cases following on retro-pubic prostatectomy. An odd case has been reported where there was no drainage of urine involved such as after trauma or confinement.

(2) Osteitis pubis is a comparatively new disease. Twenty-six cases had been recorded in the literature up to 1941, 12 of them by Edwin Beer. That the condition could have been passed unobserved prior to this is most unlikely, since most cases follow the severe pattern and the pain and disability are such that radiological investigations would inevitably have been carried out and the obvious changes discovered. My own experience has followed closely on that of most other observers. In consultation with a surgical colleague in 1944, I had seen one case following on supra-pubic prostatectomy. It was not until January, 1948, that I suffered this complication in my own surgical practice, and within nine months 6 cases had been diagnosed. It is remarkable that many urologists with an experience of thousands of cases of pelvic surgery involving the opening of the bladder have gone through their urological lives without seeing one case, whilst others with similar experience are now confronted with a spate of them.

In the search for an explanation for this recent occurrence it was early suggested that the vogue for the use of chemotherapeutic powder in the wound might provide the cause. Theoretically, this could produce rapid healing of the superficial layers of the wound and cause infection to be pent up in the depths. This theory is disproved by the fact that in this series osteitis pubis occurred in 50 per cent. of cases, in the practice of surgeons who did not use any powder in their post-operative toilet of wounds.

(3) The third factor still unsatisfactorily explained is the delay of onset from fifteen days to very much longer periods, the onset being associated with a mild degree of pyrexia but with no gross fever or constitutional signs. The intensity of the pain and disability is not comparable with that associated with similar lesions in other parts of the bony skeleton.

(4) Fourthly, changes begin with an affection of the symphysis, and a subsequent bilateral involvement of the other bones of the pelvis, associated with gross rarefaction. Complete reconstitution of the bony structure follows on cure of this self-limited disease.

(5) The almost complete lack of response to all therapeutic procedures in a disease that proceeds to resolution is anomalous and rarely seen in other conditions.

The suggestion of Beach (1949) that all of these cases occur as a result of a "septic spill of urine" is an obvious one considering the operative factors preceding the complication. He envisages a gross infection of the pre-vesical space, stating: "This clinical entity is dependent on an accumulation of urine or septic material behind the pubes overspreading the nutrient foramen." It is hard to believe that infection could be present in soft tissues and yet clinical evidence of such be consistently absent. (Pre-vesical abscess without clinical evidence has been described by Chute in one case.) He further suggests closure of the bladder and lack of adequate drainage as predominant factors, but surely again infection in the pre-vesical space with its abdominal cellulitis and constitutional disturbance would be recorded prior to the fifteen to twenty-eight days that osteitis generally takes to evidence itself. In most of the cases osteitis pubis appeared in the presence of a soundly healed abdominal wall. That an inflammatory origin for the lesion is suggested by the intensity of the pain and the amount of destruction of tissue is not denied. One would, however, expect, as in other bony infections associated with marked pain, a gross amount of constitutional disturbance with greater temperature rise. Further, one queries why an inflammatory lesion should be predominantly bilateral and slowly and symmetrically progressive. Hamm and Lavalle presented at the American Urological Association meeting of 1950, 4 cases in which biopsies of

the pubic bone had been performed and one case in which post-mortem findings were available. In each case the microscopic findings were typical of chronic inflammation. It is worthy of note that at autopsy no evidence that the bone had been laid bare was noted, nor any change in the periosteum. Many writers have advanced trauma as the main aetiological factor. Beer suggested that direct trauma by the pressure of retractors or drainage tubes, or periosteal injury from avulsion of the fibres of attachment of the rectus muscle, might provide the cause. Kirz (1947) described three factors which may be responsible: (1) the deliberate opening of the pre-vesical space, (2) avulsion of the fibres of the rectus muscle or of the two layers of the transversalis fascia attached to the pubic bone, and (3) rupture of the pubo-prostatic ligaments in the process of enucleation of the prostate. Added to these with the increase in popularity of the retro-pubic operation, the possibility of a needle prick of the periosteum has been suggested. This complication, however, has occurred in the practice of surgeons who never use anterior retractors in the wound, who always insert their drainage tubes in the upper angle of the wound, who feel certain that gentleness in handling of the rectus muscle or transversalis fascia precludes any damage to these structures, and who do not tear the prostate out of its capsule.

It has been suggested that the condition may arise from damage to the nutrient vessel of the pubis. Pathologically this tenet is insecure, since necrosis and sclerosis of the bone would result with few or none of the clinical signs and symptoms of osteitis pubis.

Wheeler (1941) rejected the inflammatory theory as a result of his failure, in a series of experiments on animals to infect the pubis or periosteum with injected urine. He preferred to ally the condition with that interesting complication of trauma to the extremities known as Sudeck's post-traumatic atrophy. Bruskewitz and Ewell (1949) also favour this explanation.

At a varying period of time after even a slight injury to the extremities, the patient presents a typical syndrome. Complaint is made of marked pain out of all proportion to that suffered from the original injury and unrelieved by immobilization. With this are associated trophic changes in the limb distal to the injury—oedema and blueness of the hand or foot. The bones in the vicinity show marked spotty osteoporosis. Following on this there is gradual destruction of cartilage, which may eventually lead to a fusion of joints and a useless extremity when recalcification eventually occurs. The cause of this condition is accepted as an interference to the nerve supply to the blood vessels of the part producing gross hyperaemia and a consequent washing out of the calcium of the bones. (Improvement has been achieved from the operation of sympathectomy.) The inexplicable onset, the prominence of pain as a clinical feature, and the gross osteoporosis suggest a similarity between it and osteitis pubis. More recently Hock and Kurtz (1951) agree with this theory supporting that a chronic inflammatory process within the pelvis may produce irritation of sensory nerves, which, through a causalgia-like mechanism, leads to pain, ischaemia, muscle spasm and trophic changes. They state that the prostate and its capsule are known to have a very rich sensory nerve supply, resulting in a greater likelihood of the development of a causalgia than the adjacent tissue and viscera. Therefore if infection and trauma involve the anterior aspect of the prostatic capsule as in retropubic prostatectomy, then the pain and reflexes will be referred to the pubic and anterior regions.

However, the two conditions of osteitis pubis and Sudeck's atrophy do not correspond accurately. The pain of Sudeck's atrophy is not relieved by rest: rather, any form of fixation increases it. On the other hand, with osteitis pubis the emphasis is on acute distress on attempt at movement, and avoidance of this appears to produce amelioration of the pain. Secondly, no trophic changes are seen over the pubes in the soft tissues. This may, of course, be related to the thickness of the tissues and the distribution of the arterial supply. Further, the pain of Sudeck's atrophy is relieved by radiotherapy, even though this treatment bears no relation to the course of the disease. Batson demonstrated in 1940 that, if a thin medium were injected into the dorsal vein of the penis, a spread was seen to the ilium, to the veins of the pelvic girdle and to the veins of the

vertebral system. This inter-communication of veins explains the almost constant metastasis of carcinoma of the prostate to the bones of the pelvis and the vertebral column.

Beneventi and Noback (1950) have studied the venous blood supply to the prostate and bladder and proved an interrelationship between these vessels and those draining the region of the symphysis and the pubis (Fig. VII). Graham Sutton has therefore favoured the hypothesis of venous thrombosis with a low grade degree of infection as the most satisfactory explanation of the clinical cause of this condition. That this is distinctly possible is suggested by the 2 cases of osteitis of the spine described by Donahue and 2 cases of osteitis pubis mentioned by Millin (1950) with associated lesions in the spinal column.

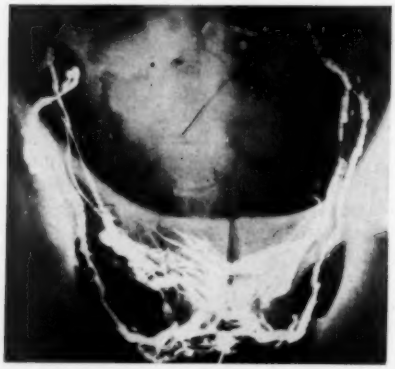

FIG. VII. X-ray picture taken of cadaver after injection of the dorsal vein of the penis with Neo-Hydriol, demonstrating the complexity of veins in this region and their close relationship to the bony pelvis. (L. J. T. MURPHY.)

DIAGNOSIS.

Whilst the condition would appear to present a perfectly clear-cut clinical picture, mistaken diagnosis may occur. The commonest cause of difficulty lies in the presence of metastatic deposits from prostatic carcinoma. I know of 3 cases assumed to be osteitis pubis whose symptoms cleared dramatically on the exhibition of oestrogens. In a further case, pain, similar to that complained of with osteitis pubis, occurring ten days after an uncomplicated trans-urethral resection led to radiological investigation. This disclosed a secondary growth in the pubis subsequently proved to be originating in a carcinoma of the large bowel. Tuberculosis in the symphyseal region produces bone destruction of a much more chronic nature, of predominantly unilateral distribution and associated with the presence of cold abscesses (Fig. VIII). The cases of obturator neuritis described after prostatectomy are, in all probability, unrecognized osteitis pubis.

FIG. VIII. Tuberculosis of the symphyseal region, showing marked tendency to unilateral involvement.

Osteomyelitis of the pubis does occur and may produce painful destruction of bone, and it is felt that some of the cases of osteitis pubis previously described, particularly where abscess formation and sequestra have been recorded, may be of this nature (Fig. IX).

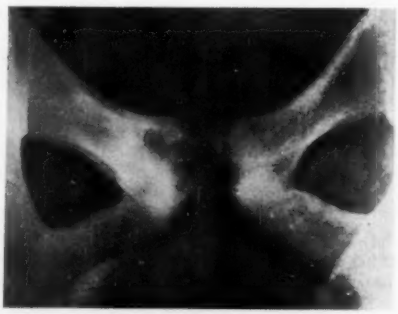

FIG. IX. Acute osteomyelitis of the symphyseal region. This lesion began in the upper ramus of the right pubic bone, involved the symphysis and produced gross destruction of bone on either side of the joint.

CONCLUSION.

In conclusion, osteitis pubis is an increasingly common disease and the actual pathology remains unsolved. As the condition appears to be related to the opening

of the pre-vesical space and the bladder in the vast majority of cases, every care should be taken to avoid any of the possible factors that have been mentioned as causative elements until such time as the exact aetiology is determined.

REFERENCES.

BATSON, O. V. (1940), *Ann. Surg.*, vol. 112, page 138.

BEACH, E. W. (1949), *Urol. Cutan. Rev.*, vol. 53, page 577.

BEER, W. (1924), *Int. J. Med. Surg.* Cited by KIRZ.

—— (1929), *J. Urol.*, vol. 20, page 233.

BENEVENTI, F. A. and NOBACK, G. J. (1950), *J. Urol*, vol. 62, page 663.

BRUSKEWITZ, H. W. and EWELL, G. H. (1949), *Arch. Surg.*, vol. 77, page 705.

CHUTE, A. L. (1929), *J. Urol.*, vol. 21, page 711.

DEAN, A. L., *Discussion Mortensen, H. Osteitis Pubis, J. Urol.* (to be published).

DONAHUE, C. C. (1949), *J. Urol.*, vol. 61, page 405.

HAMM, F. C. and LAVALLE, L. L. (1951), *J. Urol.*, (to be published).

HENDERSON, D. St. Clair L. (1950), *Brit. J. Urol.*, vol. 22, page 30.

HOCK, E. F. and KURTZ, K. A. (1951), *J. Urol.*, vol. 65, page 419.

KIRZ, E. (1947), *Brit. J. Surg.*, vol. 34, page 272.

MILLIN, Terence (1950), Personal communication.

MOORE, T. D. (1949), *J. Urol.*, vol. 61, page 46. *Discussion Mortensen, H. Osteitis Pubis J. Urol.* (to be published.)

SUTTON, Graham (1950), *Proc. Urol. Soc. Aust.*, vol. 4, page 48.

SMITH, Emerson, Personal communication.

WHEELER, K. W. (1941), *J. Urol.*, vol. 45, page 467.

FIVE UNUSUAL THORACIC CASES*

By JOHN S. MACMAHON.

Royal Prince Alfred Hospital, Sydney.

SINCE those great physicians of an older generation, Auenbrugger and Laennec, described the arts of percussion and of auscultation, great advances have been made in the diagnosis of diseases of the chest. The use of X-rays with or without contrast media, the examination of the sputum by special techniques and the direct inspection of the bronchial tree with the bronchoscope have gone far to establish accurate diagnosis. However, there still remain occasional cases where exploratory thoracotomy must be resorted to—and others in which the pathologist has the last word. Some of the cases described show such difficulties in diagnosis. Others which I have selected did not constitute a diagnostic problem, but illustrate the difficulties or complications which they presented when operative procedures were carried out. I hope that from a technical point of view they may be of interest to those practising general surgery as well as to those whose activities are confined to the thorax.

TORULOSIS OF THE LUNG.

Infestation of the body by yeast-like organisms has been attracting considerable attention in Australia during the past decade. An excellent monograph with report of 12 cases was published in 1946 by Leonard B. Cox and Jean C. Tolhurst of Melbourne.

Torulosis is a not uncommon disease, the recognition of which is increasing in frequency. There have been 11 cases of proven torulosis in the Royal Prince Alfred Hospital since 1934. It is safe to infer that prior to this date many patients were admitted to the Hospital suffering from unrecognized torular infection and what is true in this Hospital is doubtless true of other hospitals in Sydney.

CASE REPORT.

Case 1.

A.B., a male of 60 years, was referred to me by Dr. Cotter Harvey. A carpenter by occupation, he was admitted to the Royal Prince Alfred Hospital on 9th Jan., 1951. Eighteen months before he had been accepted for life insurance.

He stated that he was quite well until a year ago, when he began to suffer from fatigue and a persistent pain in the left side of his chest. He would wake up in the morning feeling tired. Commencing work at 8 a.m., he could not continue longer than two to three hours. His weakness gradually progressed and finally six months ago, unable to work any longer, he was given an invalid pension. The pain was located in the anterior part of his chest on the left side. It was dull and aching in character, made worse by exertion and relieved somewhat by rest. It would take two hours of rest to relieve the pain after it had been accentuated by work. None of the usual drugs afforded relief. His appetite was quite good and he ate a normal amount of food, but despite this he had, during the past two months, lost one and a half stone in weight. He did not suffer from headaches or vomiting.

Three months ago he developed a cough, which was worse at night and unproductive. It was often paroxysmal but not accompanied by dyspnoea. Three weeks ago he coughed up about four cupfuls of blood, since when his cough has been more persistent and productive of small amounts of sputum, streaked with blood, no more than one tablespoon a day. At no time has he coughed up a large amount of sputum.

Examination revealed a sallow-complexioned, thin man, who had obviously lost weight. There was an area of dullness with diminished breath sounds at the base of the right lung posteriorly, but no adventitious sounds were heard. His haemoglobin was 13.9 gms. per cent. and there were 11,300 white blood cells per cmm. of blood (polymorphs 86 per cent., lymphocytes 9 per cent., monocytes 4 per cent., basophils 1 per cent.). Sputum examination revealed no carcinoma cells.

A plain X-ray film of the chest showed a large circumscribed opacity in the superior segment of the right lower lobe (Fig. I).

Bronchoscopy revealed redness and oedema of the mucosa of all the basal branches of the right lower lobe bronchus. There was no evidence of tumour and no characteristic pathological change. After injection of lipiodol a bronchogram outlined the basal bronchi well, but the superior bronchus of the lower lobe was obstructed and did not fill (Fig. 1C).

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*Read at the Annual General Meeting Sydney June, 1951.

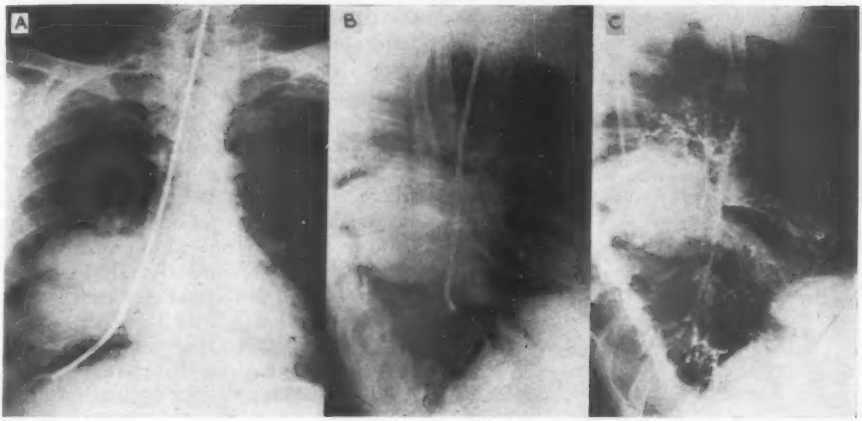

FIG. I. Case 1. (A) Antero-posterior skiagram with an intra-bronchial catheter *in situ*, showing a large torular lesion of the right lung.

(B) A lateral skiagram showing localization of the lesion in the superior segment of the right lower lobe.

(C) A lateral bronchogram, showing blockage of the superior segmental branch of the lower lobe bronchus. All the basal bronchi of the lower lobe are well outlined.

He ran a slight persistent pyrexia up to 100°. No enlarged lymph glands were found and no abnormality of the nervous system could be detected. An electrocardiogram was normal in every respect.

Nine days after admission, operation was carried out under pentothal, culissin and oxygen anaesthesia. A postero-lateral incision was made and the chest entered through the 7th intercostal space. A large semi-cystic tumour was found in the superior segment of the lower lobe and adjacent part of the upper lobe, which was free and not attached to the chest wall by any adhesions. Aspiration with an exploratory syringe produced some yellow gelatinous material. The pleural cavity contained no free fluid or any other obvious pathological abnormality. Some enlarged lymph glands were present along the oesophagus; one of them was removed for an immediate frozen section and was reported as being free from carcinoma. The pathological changes were regarded as those of an old tuberculous lymph gland. A right pneumonectomy was performed and the patient was then returned to the ward in good condition.

The pathological report of the ablated lung was as follows:—

"Macroscopic: The specimen (Fig. II) consists of the right lung. Most of the upper portion of the lower lobe is occupied by a large tumour. This tumour appears to be well circumscribed and it is growing up the divisions of the superior bronchus of the lower lobe and a portion is attached to the wall of the bronchus. There are outlying nodules of tumour. The tumour is necrotic in portions but in other portions it has a whitish translucent appearance. The surrounding tissue is rather fibrotic and dilated vessels in it are thrombosed.

Microscopic: The tumour (Fig. III) is composed of histiocytes in the main. There are lymphocytic collections here and there and fibroblasts are present throughout the tissue. *Torula Histolytica* can be seen lying in small lacunae. The lesion is a torula-granuloma."

Two weeks after operation the patient's general condition was excellent. He was gaining weight and felt well.

FIG. II. Case 1. A photograph taken of the specimen removed at operation, showing the macroscopic appearance of the lesion after section.

A lumbar puncture was performed on 15th Feb., 1951. The cerebro-spinal fluid was crystal clear and under a pressure of 80 mm. Quickenstedt's test was positive. The cell content was 63 per cmm., 95 per cent. of them being lymphocytes and 5 per cent. polymorphs. The chlorides of the fluid were 680 mgm. per cent., the sugar 25 mgm. per cent. and the protein 100 mgm. per cent. Cultures were made on Sabourand's medium and blood agar. A few colonies of *Torula Histolytica* became visible on the fourth day. Cultures made from the urine, blood and naso-pharynx were also negative.

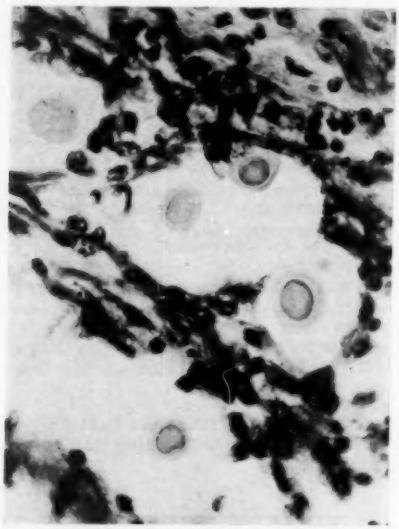

FIG. III. Case 1. A photomicrograph showing encapsulated *Torula Histolytica* lying in lacunae in granuloma—Masson's stain. (x 300.)

Case 1 is of interest as it is the only one of the Royal Prince Alfred Hospital series in which surgical excision of a torular lesion of the patient's lung was carried out. It is also an example of the difficulty of interpretation of obscure radio-opacities of the lung, which, in the absence of other positive diagnostic tests, could be one of very many lesions. The diagnosis was finally made by open thoracotomy, the suspicion at first being that the lesion was a carcinoma. Inexperience led to the non-recognition of the nature of the fluid aspirated at operation. The fluid is so characteristic that being once seen, it should be readily recognized again.

Had the pathologist found *Torula Histolytica* in the sputum, it is highly probable that the operation of pneumonectomy would never have been carried out and I should have been deprived of the experience of treating a patient suffering from torulosis of the lung by surgical excision of the organ and of the expectation that the lesion was perhaps a rare type of torular infection where the disease was confined solely to the lung. This hope was soon shattered, because five weeks after operation, a few torular colonies were obtained on culture from the cerebro-spinal fluid on the fourth day following innoculation of the medium, although at that time the patient had gained weight and had stated that he had never felt better in his life. It is of added interest that *Torula* should be found in the cerebro-spinal fluid of a patient who had no nervous signs and who stated proudly that he had never known what a headache was. Cerebral signs and symptoms are usually present before *Torula* is discovered in the cerebro-spinal fluid.

Dr. Edgar Thomson, bacteriologist of the Royal Prince Alfred Hospital, was stimulated to review the slides made from pre-operative specimens of the patient's sputum. He was able, after treating it with Gram's stain, to demonstrate the presence of *Torula*.

This case illustrates the importance of always examining a specimen of sputum by the Gram stain at least once, no matter what is the suspected clinical diagnosis. In this case a Gram stain was not used before operation because stress was laid on the search for acid-fast bacilli and carcinoma cells. Dr. Thomson has expressed the opinion that a pathologist should not confine his examinations to those asked for by the clinician, but should endeavour to be helpful and carry out such investigations as he thinks might help in establishing a diagnosis.

CASE OF PNEUMONECTOMY PERFORMED FOR MASSIVE UNCONTROLLABLE HAEMORRHAGE FROM THE LUNG.

It is not uncommon for patients suffering from chronic lung abscess or bronchiectasis to cough up sputum streaked with blood, or even to have a large haemoptysis, and although the majority of them recover when

treated expectantly, there is a definite mortality, no matter how low. It is extremely difficult to determine how high it is from the literature and available statistics and it is notoriously hard to discover how many people in the community die following an haemoptysis, since the cause of death is usually given as the primary lesion, haemoptysis being only recorded as a contributing cause.

Chevalier Jackson and Sidney Diamond, in a review of 436 non-tuberculous patients with tracheal, bronchial and pulmonary bleeding, found that inflammatory processes were responsible for the haemorrhage in the majority, the most common aetiological agent being bronchiectasis. Moreover, more than one third of the patients in their series, who had massive haemorrhages, were in the bronchiectatic group, yet in not a single instance did haemoptysis in a patient with bronchiectasis have an immediate fatal termination. This was not the case in haemoptysis of chronic lung abscess. Three of the patients in their series did die in the midst of a copious haemorrhage, but each had a non-bronchiectatic pulmonary abscess with no evidence of bronchial dilatation.

There are not many reported cases of lobectomy or pneumonectomy carried out as an immediate treatment for massive pulmonary haemorrhage, yet there must be a definite indication. The difficulty is to select patients suitable for this treatment. Case 2 is reported as an example.

CASE REPORT.

Case 2.

G. I., a male, aged 18 years, was referred to me by Dr. Cotter Harvey. He was admitted to the Royal Prince Alfred Hospital on 31st March, 1948, suffering from a massive haemoptysis of one hour's duration.

Two years before he had been thrown from a horse, and was admitted to hospital where he was unconscious for some hours. X-ray examination showed no evidence of chest injury and he was discharged with a final diagnosis of cerebral concussion. One week later he resumed work as a farmhand and carried out his duties with no distress. About three months from the date of his accident he quite suddenly coughed up some thick yellow sputum which was streaked with blood. The amount expectorated was considerable from the start and reached its present amount of approximately a cupful a day in about a month. This led him to consult his local doctor, who had his chest X-rayed again, a lung abscess being reported. As no treatment was given and he was becoming increasingly worse, his mother grew dissatisfied and consulted another doctor, who suspected tuberculosis and had him admitted to hospital, where he remained as a bed patient for two months. After investigations he was informed that he did not have tuberculosis but a lung abscess. His chest was needled on 5 or 6 occasions but no pus was found. After his discharge from hospital he was treated with mixtures during the next twelve months. The cough, however, persisted with variable amounts of sputum occasionally streaked with blood. Six months before admission he had an haemoptysis of about two cupfuls and one month ago was referred to the Thoracic Unit at the Royal Prince Alfred Hospital for investigation.

A plain skiagram of the chest showed considerable dullness of two-thirds of the left lung. There were some irregular areas of transradiolucency within it, suggesting the possibility of a lung abscess with much consolidation (Fig. IV).

FIG. IV. Case 2. An antero-posterior skiagram taken three days before operation, showing dullness and cavitation in the lower two-thirds of the left lung.

A bronchoscopy was carried out on 13th March, 1948. A considerable amount of pus was observed coming from the left lung and X-ray examination after injection of lipiodol showed cavitation and marked bronchiectasis of the left lower lobe.

On admission his haemoglobin was 10.9 gms. per cent., but as he continued to cough up large quantities of blood, a drip transfusion was commenced. During the next ten days he had repeated massive haemoptyses daily, sometimes twice a day. He became extremely pale with marked dyspnoea, tachycardia and hypo-tension, and despite a continuous drip transfusion his haemoglobin could only

be elevated to 7.8 gms. per cent. During this period five litres of blood were given. On 9th Apr., following a severe and massive haemoptysis, he developed a shock-like state. It was then decided, after consultation with his physician, that an immediate pneumonectomy would be the best means of saving his life. The operation was planned for the next day and an increased amount of blood given into his veins in preparation.

Operation was carried out the next day whilst the patient was still bleeding. He became an anaesthetic as well as a surgical problem. The anaesthetic agents, pentothal, cyclopropane and curare were skilfully administered by Dr. W. I. T. Hotton. The procedure adopted was as follows:—

As a preliminary the throat was sprayed with dessicaine and under pentothal anaesthesia Dr. E. M. Rennie packed the left main bronchus, from which blood was welling up, with ribbon gauze. The remainder of the bronchial passages were sucked clear, the blood transfusion was quickened and the operation of pneumonectomy performed, the gauze being removed along with the lung. The operation, which was rather tedious on account of dense adhesions, was carried out without any undue concern as the patient was well oxygenated and showed no cyanosis.

The pathological report of the lung was as follows:—

"Macroscopic: The specimen (Fig. V) consists of the left lung. Externally the pleural surface is somewhat haemorrhagic and is ragged from the presence of fibrous adhesions. The lung has been bisected and there are seen to be a number of large and irregular cavities set in a large amount of very dense fibrous tissue. Three cavities which at first sight appear to be separate are found on probing to communicate freely. They measure from 2 to 3.5 centimetres in diameter but are very irregular in shape and are sub-divided into locules by incomplete septa and bridles. The lining of each cavity is mainly pale, firm and slightly granular but in some parts there is blood clot in the lumen. The cavities are mainly close to the surface of the lung, being separated from it by about one centimetre of dense fibrous tissue. On the medial aspect of the cavities there are seen to be a number of large and thickwalled bronchi which are probably bronchiectatic. The fibrous tissue in which these cysts and bronchi are embedded is mainly greyish-white in colour but there are also fairly large areas which have a bright yellow colour as though from the presence of much lipoid. The lung tissue towards the base appears to be consolidated but here also fibrous tissue is somewhat increased.

Microscopic: Sections are taken from two of the large cysts and these are seen to be lined by stratified squamous epithelium. There is no keratinization on the surface but definite intercellular prickles can be seen. This epithelium is placed on highly vascular granulation tissue in which there are numerous plasma cells and the blood vessels contain a large excess of polymorphs. External to the granulation tissue the tissue is very dense and fibrous and farther out there are the remains of some lung tissue. Here the alveoli are represented by spaces and cavities lined by epithelial cells which are large and cuboidal and thickly infiltrated by lymphocytes. Farther out again the lung tissue becomes somewhat less fibrous and is very haemorrhagic. External to this there is the dense fibrous tissue of the greatly thickened pleura and the looser and more highly vascular tissue of pleural adhesions.

Pathological diagnosis: Bronchiectasis and chronic interstitial pneumonia."

During the post-operative period the patient gave little concern. Small amounts of fluid were aspirated from the chest on two occasions. He was discharged from hospital on 21st May, 1948, and since then he has carried out his usual duties without any respiratory distress. When last seen on 1st March, 1951, he was a well-browned, robust country youth, who had been working on a cattle station for the last six months as a station hand. He stated that he was able to carry out, without disability, hard work such as mustering, fencing, ring-barking and scrub cutting.

FIG. V. Case 2. A photograph taken of the specimen removed at operation. The specimen has been transected.

POSTERIOR MEDIASTINAL GOITRE.

Although much has been written about intra-thoracic goitre, it is only recently that a distinction has been made between anterior and posterior mediastinal types of that disease. Nearly all thyroid glands, as they

enlarge, descend into the anterior mediastinum behind the sternum and inner ends of the ribs and are partly substernal and partly cervical. Adams, of the Lahey Clinic, states that the term "intra-thoracic" goitre should be confined to those forms in which the goitrous mass lies in the mediastinum entirely below the level of the superior thoracic inlet.

The great majority of true intra-thoracic goitres are situated in the anterior mediastinum behind the sternum in a plane anterior to the great vessels and recurrent laryngeal nerves. Occasionally they enlarge downwards and backwards and so reach the posterior mediastinum in a plane posterior to the great vessels. Thyroid adenomatous masses have been described in various parts of the mediastinum having no connexion with the thyroid gland. Their exact origin and whether they become detached or not is unknown.

Excellent accounts of posterior mediastinal goitre with accurate anatomical details have been written independently by Adams and Sweet of Boston. Posterior mediastinal thyroids are described by Sweet as having a pedicle-like connexion with the thyroid gland, unless, of course, they have been unrecognized at a previous thyroidectomy and accidentally detached. This he explained by the fact that such goitres probably arise from the postero-lateral aspect of the lateral lobe of the gland and descend into the posterior mediastinum behind the carotid sheath in a plane posterior to the great vessels and recurrent laryngeal nerve. They lie in the posterior mediastinum against the vertebral column and tend to displace the oesophagus and push the trachea forward. As they enlarge, they present as a bulging into the right pleural cavity in an area limited posteriorly by the thoracic wall, inferiorly by the azygos vein and anteriorly by the superior vena cava. Superiorly the pedicle occupies a small space at the thoracic inlet. This space is bounded laterally by the first rib, posteriorly by the vertebral column, medially by the trachea and the oesophagus, and anteriorly by the carotid sheath and the subclavian and innominate vessels. Owing to the fixed vertebral column posteriorly, increase in the antero-posterior direction can only occur by displacement and finally by compression of the trachea and right main bronchus. When obstructive symptoms develop, it is well to remember that emergency tracheotomy cannot relieve the patient as the obstruction is below this point.

The importance of posterior mediastinal goitre lies in its diagnosis from other mediastinal tumours, such as neuro-fibroma, aneurysm, bronchial cyst, Hodgkin's disease, etc., and in the planning for its operative removal once the diagnosis is established. With modern methods available for investigation, for example, X-ray examination of the chest after introduction of intra-tracheal lipiodol, a "barium swallow" or a plain X-ray film taken after introduction of a radio-opaque tube into the oesophagus, and angio-cardiography, fewer cases will be left for diagnosis at operation and a well planned operative approach can be considered.

Small posterior mediastinal tumours can be removed through a cervical incision only, but large ones cannot be delivered through the small anatomical isthmus described into the neck and are better removed by a trans pleural approach, preferably through a postero-lateral incision. Some advocate an approach through a sternal split. When difficulty is encountered in controlling the blood supply, which comes from the neck, a combination of cervical and thoracic incisions has been employed.

CASE REPORT OF A PATIENT TREATED BY TRANS-THORACIC APPROACH.

Case 3.

E. S., a female, aged 48 years, was referred to me by Dr. E. M. Fisher and was admitted to the Royal Prince Alfred Hospital on 14th Dec., 1949, in a state of respiratory distress. Her past history showed that six years previously, she had had a sub-total thyroidectomy performed for a large adenomatous retro-sternal goitre. The pathological report had shown no evidence of malignancy and the operation notes stated that the right lobe and half of the left lobe had been removed. She remained well for a period of two years when she began to suffer from breathlessness which progressively increased, particularly on exertion.

Two months ago she developed a cough with stridor and was admitted to Parramatta District Hospital, where her difficulty in breathing became

urgent and an immediate tracheotomy was performed under local anaesthesia. This operation gave her very little relief. A few days later, as her general condition had deteriorated, she was again taken to the theatre, when it was found that the tracheotomy tube had slipped out of the trachea. The trachea was re-opened and the tracheotomy tube re-introduced, but this device again proved unsatisfactory. It was removed and a small Magill's tube was inserted and passed below the point of obstruction. The tube was stitched to the skin and gave a satisfactory airway. An X-ray picture of her chest showed a large rounded mass in the upper mediastinum displacing and compressing the trachea. An examination by an ear, nose and throat surgeon showed marked compression of the trachea below the tracheotomy in an antero-posterior direction. The available lumen was just a transverse slit.

An operation was performed on 19th Dec., 1949. A long oblique incision was made curving upwards medial to the scapula and the chest was opened through the fourth intercostal space. A few small pulmonary adhesions were divided and the upper lobe was retracted downwards. A large bulging tumour presented beneath the mediastinal pleura, extending downwards and forwards and displacing and compressing the azygos vein and superior vena cava. Posteriorly it rested on and overlapped the vertebral column. On palpation it was found to be quite fixed. The pleura was incised in a vertical direction and the tumour which obviously consisted of thyroid substance, bulged into the pleural cavity. A large plexus of dilated veins covered its surface. Collateral vessels were divided between ligatures and the tumour, which was well wedged in position, was freed with some difficulty. Its only point of real fixation was to the posterior surface of the trachea, whence it could only be freed by sharp

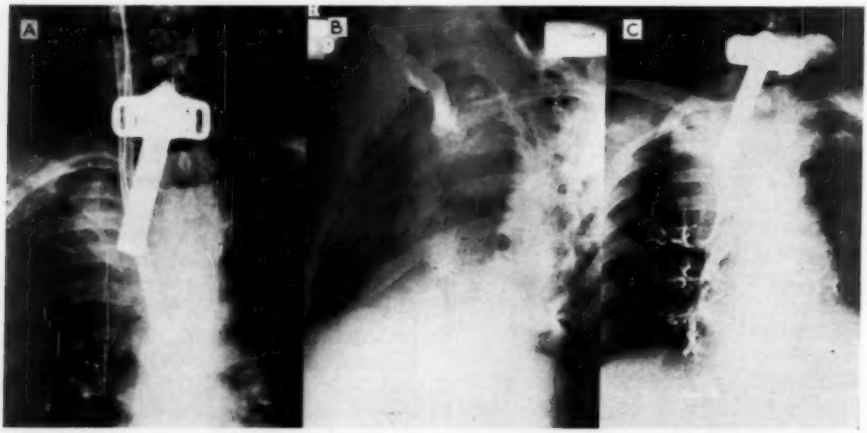

FIG. VI. Case 3. (A) Antero-posterior skiagram showing in the superior mediastinum the large shadow of a posterior mediastinal goitre. An oesophageal tube and a tracheotomy tube show deviation of the oesophagus and trachea.
(B) A lateral skiagram, showing the posterior location of the goitre, with marked anterior displacement and compression of the trachea.
(C) An antero-posterior skiagram, after injection of lipiodol through the tracheotomy tube showing the relationship of the goitre to the trachea, which is displaced forward and to the right.

On her admission to the Royal Prince Alfred Hospital considerable relief was given her by administration of oxygen. She was placed in an oxygen tent and in addition oxygen was administered through a small catheter introduced through the tracheotomy tube and passed beyond the obstruction. After a few days she was fit for investigation. X-ray examination was carried out with a small tube passed down the oesophagus (Fig. VI). This showed a large rounded shadow in the superior mediastinum. The trachea was seen to be markedly displaced forwards and compressed in an antero-posterior position. The radiological diagnosis of probably "intra-thoracic goitre" was made. X-ray investigation after lipiodol injection confirmed the above report.

dissection. After removal of the mass the trachea was seen to be still somewhat flattened and not readily regaining its regular contour. A small intercostal underwater drainage apparatus was inserted, the lung inflated and the wound closed. The tracheotomy tube was left *in situ* for a few days after the operation.

Convalescence was uneventful. Examination with a small bronchoscope was carried out by an ear, nose and throat surgeon, who reported that the tracheal lumen was re-established; the tracheotomy tube was accordingly removed.

The specimen (Fig. VII), which measured 8.5 by 5.5 by 4.5 cm., proved, on pathological examination, to be a colloid adenoma of the thyroid gland.

FIG. VII. Case 3. A photograph of the specimen removed at operation.

Case Report of a Patient Treated by Cervical Approach.

Case 4, in which a posterior mediastinal goitre originating from the left side of the thyroid gland was removed by cervical incision, is reported by way of a contrast to show that some of these goitres, when they are not large, can be removed by cervical incision only.

Case 4.

T. T., a female, aged 71 years, was referred by Dr. Cotter Harvey. She was admitted to the Royal Prince Alfred Hospital in May, 1947. She had had a cough without sputum for four years and was breathless on slight exertion. For some time she had been regarded as suffering from chronic bronchitis until a skiagram of her chest in November, 1946 showed the presence of a large mass in the upper mediastinum which was spherical in shape, as large as a tennis ball in size and which was displacing the trachea forwards and to the right (Fig. VIII). She remembered that some years ago she had noticed a lump in the left side of the neck, which her medical attendant stated was a goitre. It had suddenly disappeared and had not been noticed since.

FIG. VIII. Case 4. An antero-posterior skiagram, showing the size of the goitre removed through a cervical incision.

At operation, carried out on 3rd June, 1947, a large posterior mediastinal goitre was found, which had its blood supply coming from the left side of the neck. It extended to the right, between the trachea and the oesophagus, into the posterior mediastinum. It was removed through a cervical incision with great difficulty and only after evacuation of some of its contents. A paresis of the left recurrent laryngeal nerve followed this operation but cleared up completely.

PULMONARY ADENOMATOSIS

(In association with V. J. McGOVERN.)

The term pulmonary adenomatosis is usually used to describe a condition in which there are multiple primary tumours of pulmonary alveolar lining cells. It is a rare condition and morphologically it resembles pulmonary adenomatosis of sheep (termed *jagziekte* in South Africa).

Whereas the ovine disease behaves in an infectious manner, no transference to humans has ever been described, nor has the human disease been described in areas where pulmonary adenomatosis of sheep occurs. Hitherto, no case of multiple primary alveolar cell tumour of lung has been described either in man or sheep in Australia which has a population of over 8,000,000 people and approximately 113,000,000 sheep.

REPORT OF CASE.

Case 5.

E. P., female, aged 34 years, referred by Dr. Kempson Maddox. The patient was admitted to Royal Prince Alfred Hospital on 7th Dec., 1950, complaining of a feeling of listlessness, breathlessness on exertion and a cough for twelve months. During this period she suffered from repeated febrile attacks which were becoming more frequent. Three months prior to admission she became acutely ill with a high temperature, developed pain in the right side of the chest and had an haemoptysis of about three cupfuls of blood. She was admitted to St. Vincent's Hospital, Bathurst, where she remained until her transfer to Royal Prince Alfred Hospital for further investigation. Whilst in St. Vincent's Hospital, Bathurst, she was treated with penicillin. During this period fluid collected in the right side of her chest and 26 ounces of straw-coloured fluid, sterile on culture were aspirated. The cough continued and she began to expectorate a small amount of muco-purulent sputum, about one ounce a day. During the previous two months she had lost two stone in weight.

Her past history shows that she had no relevant previous illness and had had no operations. She was a non-smoker and a total abstainer, who lived all her life in country towns. The only contact she had with sheep was when she resided on a sheep property in the Bathurst district for a period of nine months in 1938 and for a few months prior to admission to hospital she had kept a pet lamb. For the last few years she has worked in a café, of which she was part owner, up to sixteen hours a day.

Examination revealed her to be a moderately obese woman, who, despite her appearance, had lost weight. There was no clubbing of the fingers nor deviation of the trachea. Physical examination of her chest showed dullness to percussion with diminished breath sounds at the right base, accompanied by coarse rhonchi and rales. Vocal resonance and fremitus were also diminished in this area. Examination of her cardio-vascular system revealed no abnormality and her electrocardiogram was normal.

Her haemoglobin was 13.9 gms. per cent., white cell count 10,400 per cmm. The differential count showed 80 per cent. neutrophils, 15 per cent. lymphocytes, 4 per cent. monocytes, 1 per cent. oesinophils.

X-ray examination (Fig. IX) revealed a mottled opacity in the region of the superior segment of the lower lobe of the right lung, somewhat pyramidal in shape, with the base towards the vertebral column. The edges of the opacity were in part clear cut, but elsewhere wavy and undefined. The appearance suggested an inflammatory lesion, but the possibility of a neoplasm could not be excluded.

Her vital capacity was 2.5 litres. Mantoux reaction tests were negative in strengths 1 in 1,000 and 1 in 100. The Casoni test was negative. Examination of sputum showed a muco-purulent sputum with moderate numbers of pus cells; colonies of gram positive and gram negative diplococci were seen; no fungus or carcinoma cells were seen and culture produced no fungus or acid fast bacilli.

A bronchoscopy was performed on 13th Dec., 1950, by Dr. E. M. Rennie, who reported that the trachea and carina were normal. The right main bronchus was slightly congested and contained muco pus. A bronchogram was performed but this did not reveal any abnormality.

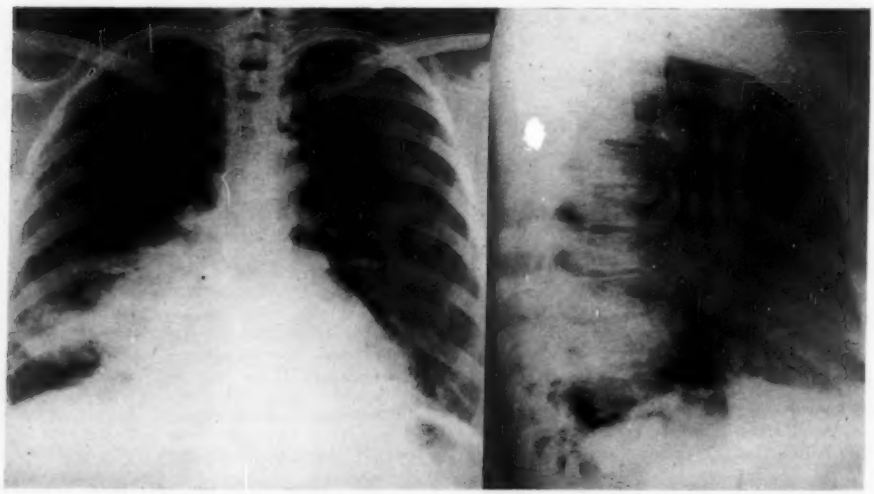

FIG. IX. Antero-posterior and lateral skiagram showing pulmonary adenomatosis of the right lung.

Her general condition improved a little with rest in hospital and as she had then only slight elevations of temperature, it was decided that an exploratory thoracotomy should be carried out.

Operation was performed on 26th Jan., 1951, under pentothal, tuberine, cyclopropane and oxygen, administered by Dr. W. I. T. Hotton. The chest was opened through a postero-lateral incision in the 7th intercostal space. The lower lobe was found to be very firm on palpation with dense adhesions to the diaphragm. There was a little pleural fluid and the superior segment of the lower lobe was covered by a whitish mucoid exudate, whose slimy nature made the lobe very slippery and difficult to handle. A right lower lobectomy was contemplated but owing to the infiltration extending from the lower to the upper lobe, obliterating the inter-lobar fissure, and the unusual nature of the lesion, a pneumonectomy was performed.

The patient's general condition remained well after operation until the fifth day, when her general condition deteriorated and she died suddenly on the sixth day after operation.

FIG. X. Longitudinal section through the lung showing the nodular nature of the tumour at the periphery with coalescence in the centre.

Biopsy Report.

The specimen consisted of the right lung (Fig. X). The lower lobe was disproportionately larger than the middle and upper lobes. The pleura was thickened and somewhat scarred and there had evidently been fairly dense adhesions which had been divided at operation. The lower lobe, posteriorly, was partially segmented into three subsidiary lobes. On section, numerous translucent tumour nodules were found throughout most of the lower lobe and these had coalesced to form a solid mass in the centre. These nodules had a mucinous feel and the non-tumour portions of the lobe had a gelatinous appearance. Exploration of the bronchi revealed no abnormality. The upper and middle lobes appeared normal.

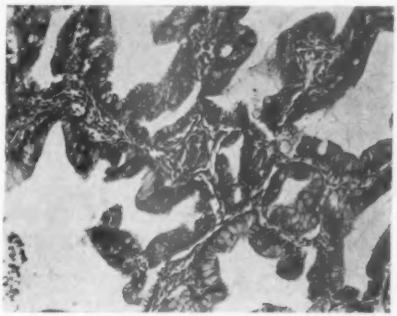

FIG. XI. Microscopic appearance of the tumour showing tall columnar mucus-secreting epithelium lining the alveoli. Haematoxylin and Eosin. (x 150.)

Histological examination (Figs. XI and XII.) The tumour is composed of tall eosinophilic mucus-secreting epithelium which has replaced the normal alveolar lining. It does not encroach upon the basement membrane which appears normal. The alveoli contain mucus and occasional desquamated columnar cells. The outlying nodules have the same structure and in areas which macroscopically had no tumour, minute foci of metaplasia to similar tall mucus-secreting epithelium can be seen. The alveoli in the lung tissue surrounding the tumour contain mucus and a few macrophages. Their lining appears normal. No abnormality can be seen in sections from the upper and middle lobes.

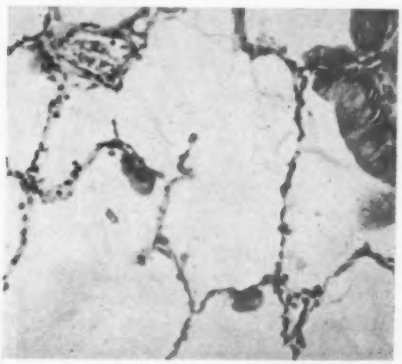

FIG. XII. Small foci of metaplasia to columnar epithelium in the outlying alveoli. Haematoxylin and Eosin. (x 300.)

At autopsy, death was found to be due to haemorrhage from an intercostal artery. No pathological change was found in the left lung.

COMMENT.

The available evidence seems to indicate that there is no relation between pulmonary adenomatosis of sheep and morphologically similar conditions of humans such as the case described in this paper.

The nature of the tumour nodules in this case is a matter of debate. The appearances suggest a multi-centric metaplasia of alveolar lining cells to form an obvious mucus-secreting epithelium which lines the alveoli in a regular fashion and does not infiltrate beyond the limits of the basement membrane.

Seeding from some primary focus must be considered, in that free cells can be demonstrated in some alveoli. If such were the mechanism of formation of the discrete foci, one would expect similar seeding in the bronchi and bronchioles and perhaps in other lobes of the lung. No bronchial or bronchiolar involvement could be found in an extensive search.

In a review of all the cases up to April, 1949, Griffith, McDonald and Clagett found 51 acceptable cases of alveolar cell tumour of the lung, and to these they added 7 more cases. In 48 per cent. of cases there were metastases.

SUMMARY.

Some interesting cases met with in the surgery of the chest are reported which include:—

1. Torulosis of the lung.
2. Massive pulmonary haemorrhage treated by pneumonectomy.
3. Posterior mediastinal goitre.
4. Pulmonary adenomatosis.

A short description has been given of the above clinical conditions. The difficulties of diagnosis and technical problems encountered at operation have been described.

ACKNOWLEDGEMENT.

I am indebted to Mr. Reg. Johnson of the Department of Medical Film Research, Royal Prince Alfred Hospital, for all the photography.

REFERENCES.

ADAMS, H. D. (1949), *J. Thorac. Surg.*, vol. 19, page 741.

COX, L. B. and TOLHURST, J. C. (1946), "Human torulosis." Melbourne, University Press.

GRIFFITH, E. R., McDONALD, J. R. and CLAGETT, O. T. (1950), *J. Thorac. Surg.*, vol. 20, page 949.

JACKSON, C. and DIAMOND, S. (1942), *Amer. Rev. Tuberc.*, vol. 46, page 126.

SWEET, R. H. (1949), *Surg. Gynec. Obstet*, vol. 89, page 57.

MUCOUS CYSTS OF THE FINGERS.

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Facts do not cease to exist because they are ignored.
Aldous Huxley; "Proper Studies," p. 247.

CYSTS of the fingers, usually small in size and found on the dorsal aspect of the distal part of a digit, are often seen in an out-patient department of a general hospital. The patients may be referred to a dermatological unit but are found more commonly in a surgical clinic. The importance of the cysts to the practitioner is due largely to their frequent recurrence after surgical removal. The condition does not cause serious inconvenience but there may be some discomfort and they are regarded as unsightly or are "in the way." If they have recurred after removal the patient's attention is fixed on them and they become correspondingly important.

On the other hand it is apparent from a perusal of the literature that there is a wide diversity of opinion regarding the origin, structure and relations of such cysts. Some accounts emphasize certain features and ignore others so that a review of them is given here.

NOMENCLATURE.

Several names have been given to the cyst, some purely descriptive, others indicating some special view as to its nature or ætiology. Thus there is "cystic nodule of the finger" (Nachlas, 1932), "recurring myxomatous cutaneous cyst" (Gross, 1937) and "peri-articular fibroma" (Savatard, 1924). The mucoid and cystic character of the condition is emphasized by the terms "synovial lesions of the skin" (Eliassow and Frank, 1942; McKee and Andrews, 1922), and "peri-ungual ganglion" (Othaz and Conti, 1945). Although the histological changes resemble those seen in ganglia and false joints there are sufficient differences (which will be discussed) to make it desirable to emphasize these in terminology. The condition is referred to here, therefore, as a "mucous cyst"; ganglia are recognized and described as distinct and different structures.

HISTORICAL.

The first clear account of this condition was given by Jones and Makin of St. Thomas' Hospital (Bunnell, 1944). It was mentioned in some of the text-books of dermatology at the end of the last century but nothing appeared in the current literature until 1913, when articles by Lingenfelter and Ormsby appeared in the Journal of Cutaneous Diseases. In 1916 a paper on the radium treatment of this condition was published (Sutton) and in 1918 Fordyce gave the term "nail cysts" to these structures. Further short accounts appeared in 1921 (McKee and Andrews) and in 1928 (Letulle and Bazy), but the first review of any consequence did not appear until 1937 (Gross). Incidentally this was the first paper on this subject to appear in a surgical journal.

Gross made clear, what had been confused before, that the condition is one confined to the subcutaneous tissues. Many of the earlier reports referred to synovial lesions and there is no clear separation of the mucous cyst from conditions of the tendon sheaths or joints, that is, the ganglia.

In 1932, an article by Nachlas referred to the relation of these cysts to Heberden's nodes, and, indeed, it is doubtful whether the condition to which he refers is not, in fact, a cystic peri-articular nodule. That the mucous cyst may be associated with joint diseases is well known and was emphasized later by Stecher and Hauser (1948). In 1947 a paper by Anderson dealt with the question of degeneration of the connective tissues in the subcutaneous region as the important factor in the development of the cyst. This paper indicates very clearly the gross confusion that has existed, as to the nature of the cyst, ever since they were originally described. A further case is recorded by Woodburne (1947).

It is quite clear that there has been no appreciation of the true relation between cysts of synovial nature, that is to say, the ganglia, and these cysts which occur in the subcutaneous tissues. This arises from a lack of appreciation of the nature of the changes which occur both in the development of ganglia and in the cysts which occur in the subcutaneous tissues, particularly in that neither communicates with any joint cavity. In the sense that each cyst, mucous cyst or ganglion, is due to a change in a connective tissue they are indeed similar, but the importance attached to the name "synovial cyst" has persuaded investigators that the cyst of the finger must necessarily be closely related to the adjacent tendon sheaths or joints.

Whatever similarity there may be in the mode of formation of the structures in the early stages, there is no doubt that the clinical condition as observed in the fully formed state is quite different. The mucous cyst is clearly a different kind of condition, from the clinical point of view, from the ganglia on the one hand or from the cystic conditions in peri-articular nodules on the other.

PATHOLOGY.

It is apparent therefore, that several distinct conditions, which are distinguishable morphologically and by their course, have been grouped together and it is necessary to place them in separate categories. These conditions are:

1. The mucous cyst of the finger.
2. The ganglion; the peri-articular or peri-tendenous synovial cyst.
3. The peri-articular fibrous nodule, which may be cystic.

These conditions are quite different in their site and course, and, to some extent, their mode of development, so that it is remarkable that they should have been confused by various writers. Confusion is due partly to certain similarities at some stages, to the occurrence of these conditions together in the same patient and to the lack of appreciation of some fundamental features of the subcutaneous and peri-articular tissues which will be discussed.

The mucous cyst of the finger is the important condition from the present viewpoint but the others will be discussed in so far as they have to be distinguished.

MUCOUS CYSTS.

The mucous cyst occurs in several forms which differ somewhat from each other. The average type will be discussed first.

General features.

The cyst develops in the subcutaneous tissues of the fingers and is quite separate from adjacent joints. It occurs usually on the dorsal aspect of the terminal segment of a digit (Fig. I) and commonly near the nail (Fig. VII).

FIG. I. Photograph showing a typical mucous cyst on the dorsal aspect of the distal digit of the middle finger. The patient, a tailoress, aged 52, had had the swelling for six months when it was excised. It recurred almost immediately and had been present again for three months. The recurrence had occurred at almost the same site as the original cyst.

Incidence.

It occurs in adult females in 75 per cent. of cases. The ages of the patients range from 25 to 70 years. Usually the long finger is affected but any one of them, including the thumb, may be involved. Commonly the cysts are found on the fingers but sometimes the toes are affected (Gross, 1937). The

right hand is affected about 4 times as often as the left. Usually only one digit is involved at a time and even when several digits are affected this takes place consecutively rather than concurrently. However, I have seen four cysts of the fingers present in one individual at one time. Very occasionally both hands may be affected.

Clinical features.

Swelling may appear over the dorsum of the terminal segment without symptoms but it is usual for the patient to have observed an uncomfortable pricking or burning sensation; this is often worse at night. There may be mild tenderness. These symptoms, when present, are to be observed in the early stages of the development of the cyst and when it is more fully formed such symptoms disappear.

When the patient is first seen, the condition has usually been present for some time, usually a matter of months. There may be a history that the patient has relieved the condition by incising the cyst with a sharp needle or there may be the story of an excision of a cyst previously.

This previous excision of a cyst is a common phenomenon which means that recurrence after removal is frequently to be seen. Careful observation will show that it is not necessarily a recurrence in the sense that the same cyst has returned. It may be found that the cyst is at some slight distance from the scar of the previous incision.

Morphology.

The cysts vary considerably in size ranging from the size of a pin's head up to 1 cm. in diameter. They may be rounded or more usually oval in general form. They are not usually very prominent and they have a smooth, rounded conformation.

They vary somewhat in depth. There may be a thickness of tissue over them so that they do not appear obviously cystic but on the other hand they may be obviously vesicular. In such cases there is very little tissue between the cyst and the epidermis. It should be mentioned that some cysts occurring in the epidermis have apparently been described as being cysts of this kind (Montgomery and Culver, 1922).

The cyst occurs at various places on the dorsum of the distal part of the digit. It may be near the region of the joint or on the other hand in close proximity to the nail.

Macroscopic appearances.

The small cyst is generally oval in form. In the early stages the middle part of the cyst which is composed of mucoid material merges into the surrounding tissues but in the well-developed and later cyst there is a well-defined capsule. This capsule may be thin and in the cases mentioned earlier, which are vesicular in form, it is particularly thin on the skin side and there may be very little tissue between the mucoid content of the cyst and the overlying epithelium. In the older cysts the contents are more fluid and will escape if the cyst be punctured or incised.

Histological features.

In the early stages the condition may not be recognized as a cyst. There is a mucoid change in the connective tissue, the cells becoming more irregular and spider-like in form and the intercellular material is obviously mucoid but the cells are not, at this stage, separated widely from each other —indeed the affected area is composed of merely a well-defined mucoid tissue (Fig. II).

FIG. II. Photomicrograph of a section of a mucous cyst showing a change of the connective tissue in the dermis into a mucoid tissue. There is not at this stage a definite cavity formed. (x 24.)

As the process proceeds there is a further change in this tissue, the cells becoming more widely separated from each other; in the middle part of this the material becomes more fluid and the recognizable cells disappear (Fig. III). This fluid area gradually merges into the uninvolved collagenous tissue

of the surrounding material. As the process progresses the amount of the recognizable mucoid tissue, between the fluid on the one hand and fibrous tissue on the other, gradually diminishes (Fig. IV).

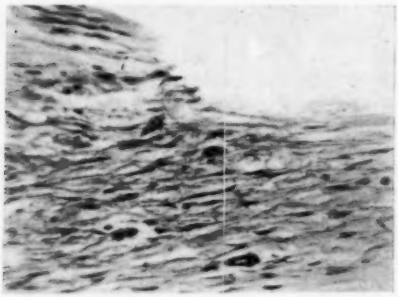

FIG. III. Photomicrograph of portion of the wall of a cyst showing the region where the connective tissue is changing into a mucoid type. This is merging into the cavity of the cyst. (x 240.)

In the well developed cysts there is a clearly-defined wall lined by a modified connective tissue which may be collagenous right up to the cavity of the cyst (Fig. V). On the inner side there is the fluid material in contact with this layer without any intervening layer of mucoid tissue between the contents of the cyst and the surrounding connective tissue (Fig. VI).

There is no evidence of haemorrhage nor are wandering cells found in the neighbourhood of the cyst; there is none of the proliferation of the fixed cells of the part as occurs in inflammatory conditions nor is there a gross change in the vascular arrangement. From this it is clear that the change is not an ordinary inflammatory one in the connective tissue. It is one of a metaplasia of the tissue, that is, a change of the ordinary fibrous tissue into a mucoid type.

When the cyst develops in the region of the nail bed there may be a disturbance of the growth of the nail (Anderson, 1947). This takes the form of a longitudinal groove in the nail and an example of this is shown is Fig. VII. It is apparent that, at the site of the disturbance of the tissue where the cyst arises, there is also involvement of adjacent structures and when this is in the region of the nail bed the growth of the nail is affected.

Association with other conditions.

The occurrence of these cysts in patients who have ganglia or peri-articular nodules is a well substantiated observation. In addition the similarity of the material in the

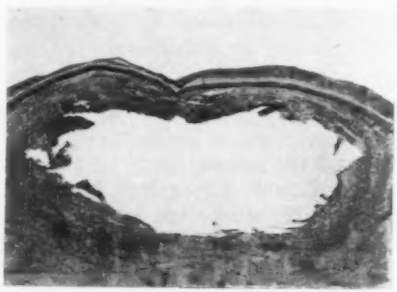

FIG. IV. Photomicrograph of a typical mucous cyst of the finger showing a cavity in the dermis. This had been filled with a mucoid material. Around the margin of it there is a mucoid tissue which, in turn, merges into the surrounding connective tissue. (x 24.)

cyst to the material found in joints and bursae was observed from the time of the earliest observations on these conditions.

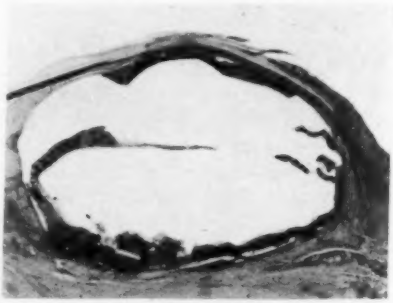

FIG. V. Photomicrograph of a section of a cyst of the finger showing precipitated mucin at the margin of the cyst. Ordinary fibrous connective tissue is to be seen right up to the wall of the cyst. Cf. Fig. VI. (x 24.)

Thus, though the typical examples of each are quite distinct and indeed it is desirable that, from the clinical point of view, they should be clearly segregated from each other, nevertheless there are features common to all of them which should be appreciated. In any case, their simultaneous occurrence in the same individual demands some consideration.

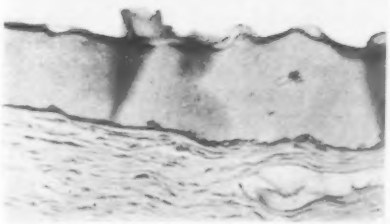

FIG. VI. Photomicrograph of a section showing the wall of the cyst. (See Fig. V.) A layer of precipitated homogeneous mucin is seen attached to the wall of the cyst. The wall itself is composed of normal fibrous tissue and there is no gradation here, in the form of mucous tissue, between this tissue and the cyst contents. (x 240.)

Treatment.

The importance of treatment by radium and X-ray (Jacox and Freedman, 1941) has been emphasized. Statements in the recent literature suggest that the results of treatment may not be so good as was originally thought.

The results from surgical treatment are, however, quite clear cut. It is obvious that a simple removal of a cyst is likely to be followed by recurrence of the condition. This does not mean necessarily a recurrence at the exact site of the original cyst but is a recurrence in the area. If, however, the whole area of the skin of the dorsum of that segment of the digit be removed and replaced by new skin, in the form of a graft, then recurrence will not take place. It would seem that the whole area is likely to be affected by this change and only removal of the area, if surgical treatment is to be undertaken, will be satisfactory.

The cyst develops by a change of the fibrous tissue of the subcutaneous region into mucoid tissue. With progression of this change the material becomes more and more fluid until a complete cyst is formed. There is no evidence at any time of a communication, in the morphological sense, with an adjacent joint or tendon sheath.

It has been demonstrated (Eliassow and Frank, 1942) that injection of radio-opaque material into the cyst will be followed by the passage of this material into an adjacent joint. The conclusion that this indicates a communication of the cyst with the joint ignores the observation that injection of material into a subcutaneous tissue near a joint may be followed by the passage of that material into the synovial cavity. It has been known for a long time that the normal lymphatic spaces of the peri-articular region may communicate with the joint.

FIG. VII. Photograph of the middle finger of a male aged 69. A mucous cyst in the tissues close to the nail is to be seen and there is a well defined grooving of the nail.

The factors responsible for the change in the tissue are not understood. At the same time the underlying factors, at present designated vaguely metabolic, hormonal or the like, responsible for the production of ganglia or of Heberden's nodes or peri-articular nodules are in like state. It is still idle, though doubtless entertaining, to speculate on the influence of the secretions of the cortex of the adrenal in this regard.

GANGLION.

A ganglion is a cyst, often multi-locular, usually appearing in the region of a joint or tendon sheath, containing mucoid material and being lined by a modified connective tissue, that is to say, by synovial membrane. It might be noted here that such a structure does not communicate with the adjacent joint or tendon sheath—a point of importance when we consider the statements that, because a mucous cyst is (erroneously) thought to communicate with the nearest joint, it should therefore be designated "synovial" or a "ganglion."

Although the ganglion may be associated with a mucous cyst of the finger, there should be no question of confusion between the two conditions in the typical form. The ganglion usually occurs in the region of the wrist joint or in the region of the tendon sheaths on the back of the wrist. However, difficulty may arise if the ganglion occurred on the back of the distal segment of a digit. In such cases, however, the ganglion is a much deeper structure, occupies a wider area than does the mucous cyst, is usually more proximal in position and is never vesicular in appearance. The "subcutaneous digital dorsal bursitis" described by Howard (1939) and in the literature referred to as if it were a mucous cyst, is a true ganglion.

FIG. VIII. Photograph of the left hand of a male aged 71 who had had gradual swelling in the front of the distal part of the little finger for two years. The swelling had an irregular contour and was translucent. See Fig. IX.

Macroscopically the ganglion always has a much better defined wall, is more voluminous and may be multi-locular. Even when it is not obviously multi-locular tiny locules may be found in the wall.

Histologically, the ganglion, though similar to the completely formed mucous cyst, does not usually show the same degree of mucoid change in the early stages. Cellular activity, as indicated by the size of the cells present, is more prominent in the ganglion and the formation of fluid occurs at an earlier stage. Thus the formation of a well-defined wall with a clear connective tissue lining is a prominent feature in a ganglion and only occurs at a late stage of the mucous cyst.

Thus, if all the features are taken into consideration, it will be seen that, even in the cases where there may be considerable similarity in their general position and in the stage of development, there is little difficulty in distinguishing a mucous cyst from the ganglion.

FIG. IX. Photograph of the specimen after removal of the finger. A multi-locular cyst related to the flexor tendon is shown. This cyst is different in form and in position from the mucous cysts. It is related to the ganglia.

An indication of the atypical forms which may develop are given in the case shown in Fig. VIII.

This patient, a male aged 71, had had a gradual swelling of the front of the distal part of the little finger for two years. When he was seen, there was the gross swelling as indicated in the figures and the condition was obviously cystic—the skin being thinned and the cavity being easily trans-illuminated.

It was found impossible to remove the cyst satisfactorily and amputation of the finger was done. The specimen is shown in Fig. IX, and it will be seen that in this case we have a cyst which is clearly of the synovial type and is closely related to the tendon sheath.

This case is illustrated in order to demonstrate the peculiar forms which some of these conditions adopt. There is no problem in the diagnosis of this particular example from a mucous cyst of the finger.

HEBERDEN'S NODES.

There has been a good deal of discussion as to the nature of Heberden's nodes. Although on the authority of Charcot these are exostoses at the margins of the joints, perusal of Heberden's original contributions would suggest that he described what is now known as peri-articular nodules. It is the peri-articular nodules which are discussed here.

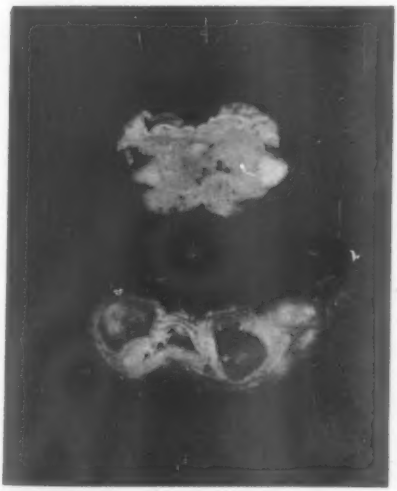

FIG. X. Photograph of two specimens of peri-articular nodules. The upper one is a solid one and the lower shows cystic change. These structures lie in the subcutaneous tissues and show histologically the characteristic features of peri-articular nodules.

These nodules are masses of fibrous connective tissues which appear usually, though not invariably, in the region of joints. They are subcutaneous in position, firm and round in consistence and are usually moveable over the deeper structures.

On cross section they are usually firm fibrous structures which may have some areas suggesting a necrotic or degenerative change. Occasionally definite cysts may be found in them (Fig. X).

Histologically these nodules have a very characteristic appearance. There are areas of necrosis surrounding which the spindle cells are arranged in a palisade form. Cystic change may develop in any of these nodules, and cysts may be single or multi-locular.

In the early stages spherical masses of necrotic material are found in the cavities and the wall is made up partly of necrotic tissue and fibrous tissue, also showing the characteristic cellular arrangement just mentioned, may be found. In the later stages, however, differentiation of the wall occurs until the lining of the wall may histologically be indistinguishable from that of the late stages of either the mucous cyst or of a ganglion.

The differential diagnosis of this condition from the mucous cyst is not likely to be difficult if sufficient information is available. In almost all cases the condition is a typical peri-articular nodule, being related to a joint and lying in the deeper layers of the subcutaneous tissues. They do not usually approach the epidermis and when they do, as they may rarely, they suggest a semi-solid structure and do not show the vesicular or semi-translucent appearance of the mucous cyst.

DISCUSSION.

The nature of the change which occurs in areolar or fibrous tissue during formation of a mucous cyst of the finger is of fundamental importance. It is sometimes suggested that this is of academic rather than of practical importance but one practical feature in the present case is indicated by the confusion that has occurred as a result of the easy acceptance of certain points of view as being self-evident and not requiring any confirmation from other sources.

It has been stated, for example, that the condition is one of a degeneration (Gross, 1937; Anderson, 1947). Such an opinion is likely to lead to such ideas as that the condition is due to old age. When we consider this we find that it is thoroughly stultifying because we do not understand what

factors give rise to the changes which we associate with old age. Indeed it is not clear that these changes seen in the aged are necessarily in any way directly associated with the ageing of the body.

When we consult the Oxford English Dictionary we find that degeneration is a declining from a state of former excellence or a reversion to a lower type. We have to be very careful of our criteria, if we are going to say that a mucoid tissue is not as good as a fibrous tissue, or that it is a lower type of tissue. If we consider a joint and the changes which may occur in it in, for example, infections, few would argue that fibrous tissue in a joint is a better tissue; in fact we would then say that fibrous tissue is, from that point of view, a lower form of tissue than the synovial tissue which, of course, is mucoid in character.

We do say that the fluid in a cyst is not as good as the tissue that was there before but, as just mentioned, when we consider that we view a bursa or joint quite differently, it is quite clear that such notions have a thoroughly anthropocentric flavour. It is merely a question of the particular point of view at the time and what we would regard as being in our own immediate interests.

It is thus clear that we have two mixed ideas: one is that the change which occurs in the formation of these cysts is a degeneration and on the other hand, we have from the earliest descriptions of the cyst the notion that they are synovial in form. What then is a synovial tissue?

This is too large a subject to discuss here in detail but it has been dealt with previously (King, 1931, 1933, 1940). The most cogent argument regarding its nature is that the cells in a synovial tissue, at the stage when fluid is being formed, are in a state of activity. They do not show signs of degenerative change in the sense that they are adopting a lower form or that they are less "good" than they were previously. Observations on the Golgi apparatus, which is, probably other than the mitochondria, the best morphological criterion of activity of protoplasmic function, indicate that during the formation of a ganglion or joint cells are, if anything, more active than at other times.

An important point is that synovial tissue may arise anywhere in the body where there is connective or areolar tissue. This is well shown by the formation of subcutaneous "false" bursae and is well shown not only in the "false" bursae round joints such as the elbow, shoulder and over the cervical spine but also in other parts of the body, where there is no joint tissue, as on the top of the head. An important factor in these cases is the pure mechanical effect of pressure, usually with some sliding component, on the tissues. It does not follow, however, that all cases of development of bursae or of structures like bursae would be due to such factors. Whatever the exciting cause the nature of the change in the tissues, however, is similar, that is, there is a change from ordinary collagenous or areolar tissue into tissue of the mucoid type.

Observations on the histological structure of the mucous cysts show that their walls ultimately come to resemble synovial tissues. Thus, not only is the structure of the wall like that of a joint or ganglion but the material in the cyst is similar. This, of course, is the reason why the older observers referred to them as synovial cysts.

Thus, from the point of view of the fundamental processes involved, it is clear that we are dealing with the same kind of change. Whether it be a normal process, that is, one that can be observed every day, or whether it be one that only occurs occasionally and in special circumstances it is clear that in all the cases there is a change of a fibrous connective tissue into mucoid tissue and formation of a "synovial" lining to the cyst.

The problem is that we can look at these conditions in two ways, either from the point of view of fundamental processes or the clinically observed condition which is the late result of these changes—a late result which is different in different cases. Thus, to emphasize the fundamental similarity of the changes that produce the mucous cyst to those which produce a ganglion has much to commend it. At the same time if the clinician wishes to emphasize the fundamental similarity by calling the skin cysts "synovial," he must not attempt to apply

false ideas of the necessary connection of such cysts to the neighbouring joints. He must be aware that ganglia do not connect with joints and are not due to degeneration of tissue.

SUMMARY.

1. The condition of mucous cysts of the fingers has well-defined clinical features and is due to mucoid change in the subcutaneous tissues.

2. The condition is not "synovial" in the sense that the cysts are related to or communicate with joints.

3. Ganglia and synovial cysts are clinically distinguishable conditions.

4. Fundamentally the processes in the two conditions are similar but, though this is important pathologically, it should not be allowed to sustain the confusion which has arisen in the literature concerning what are, in their fully developed forms, distinguishable conditions.

5. Peri-articular nodules may occur also in cystic form but are readily distinguishable by their site and structure.

6. Thus the three conditions which have been confused in the literature and which may become morphologically similar by synovial differentiation of their tissues are:

   (i) mucous cysts of the fingers,

   (ii) ganglion,

   (iii) peri-articular nodules.

Clinically they are readily distinguishable.

REFERENCES.

ANDERSON, C. R. (1947), *Arch. Derm. Syph.*, vol. 55, page 828.

BLACK, B. M. (1935), *J. Bone Jt. Surg.*, vol. 17, page 172.

BUNNELL, S. (1944), "Surgery of the hand," Philadelphia, J. B. Lippincott & Co.

ELIASSOW, A. and FRANK, S. B. (1942), *Arch. Derm. Syph.*, vol. 46, page 691.

FORDYCE, J. A. (1918), *J. Cutan. Dis.*, vol. 36, page 589.

GROSS, R. E. (1937), *Surg. Gynec. Obstet.*, vol. 65, page 289.

HOWARD, N. J. (1939), *Surgery*, vol. 5, page 939.

JACOX, H. W. and FREEDMAN, L. J. (1941), *Radiology*, vol. 36, page 695.

KING, E. S. J. (1931), *Surg. Gynec. Obstet*, vol. 53, page 606.

—— (1935), *J. Path. Bact.*, vol. 41, page 117.

—— (1940), *Surg. Gynec. Obstet.*, vol. 70, page 150.

LETULLE, M. and BAZY, L. (1928), *Ann. d'anat. path.*, vol. 5, page 937.

LINGENFELTER, G. P. (1913), *J. Cutan. Dis.*, vol. 31, page 647.

MCKEE, G. M. and ANDREWS, G. C. (1922), *Arch. Derm. Syph.*, vol. 5, page 561.

MONTGOMERY, D. W. and CULVER, G. D. (1922), *Arch. Derm. Syph.*, vol. 5, page 329.

NACHLAS, I. W. (1932), *Arch. Surg.*, vol. 25, page 1067.

ORMSBY, O. S. (1913), *J. Cutan. Dis.*, vol. 31, page 943.

OTHAZ, E. L. and CONTI, A. L. (1945), *Semana méd.*, vol. 1, page 814.

SAVATARD, L. (1924), *Arch. Derm. Syph.*, vol. 9, page 441.

STECHER, R. M. and HAUSER, H. (1948), *Amer. J. Roentgenol*, vol. 59, page 326.

SUTTON, R. L. (1916), *J. Amer. Med. Assoc.*, vol. 66, page 565.

WOODBURNE, A. R. (1947), *Arch. Derm. Syph.*, vol. 56, page 407.

LARYNGEAL AND SUB-GLOTTIC TRACHEAL STENOSIS.

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THE types of stenosis which it is proposed to discuss are traumatic and inflammatory in origin. Tumour formations which may encroach upon the airway present a quite different problem. Glottic spasm or the loss of abductor power in cases of recurrent nerve paralysis, or fixation of the crico-arytaenoid joint will always have to be born in mind, since such may result from the same trauma or inflammatory process as gives rise to cicatricial stenosis, and they may complicate the process of restoration of a satisfactory airway.

Penetrating wounds as from a bullet, shrapnel or stabbing may lead to partial destruction of the supporting framework together with laceration of the delicate mucosal and submucosal soft tissues. A blow on the larynx may fracture the framework and cause effusion beneath the mucosa with a similar train of events. Over-forceful or misdirected intra-laryngeal instrumentation such as in the passage of a bronchoscope or an anaesthetist's tube, or removal of papillomata simultaneously from both vocal cords may lead either to adhesions between opposing parts or, should submucous effusions or perichondritis be induced, to thickenings or secondary contractures. While any of the above-mentioned events may cause stenosis of the sub-glottic trachea, it is often observed that contractures in this region are particularly prone to develop with a too highly placed tracheotomy, particularly in little children in whom there appears to be special proclivity to sub-glottic stenosis. Should infection be superadded to trauma, perichondritis may develop when infiltration, contractures and distortion and adhesions will be greatly increased.

Certain measures may be adopted in an endeavour to prevent stenosis of the airways. After any laryngeal or tracheal trauma of sufficient degree to cause tearing of the mucosa, fracture of the supporting framework or marked submucosal effusion, the early use of laryngeal core moulds as devised by Jackson (1945) is advisable: such internal support and dilatation should be persevered with until healing is complete.

Once stenosis has become established the restoration of an adequate airway provides a problem which will tax both the ingenuity and patience of the surgeon, to say little of the unfortunate patient. Two measures are at the disposal of the surgeon; dilatation, or excision of cicatrices with grafting and again dilatation. Although there have been case reports of effective dilatation with bougies of increasing calibre, experience has been that in-dwelling obturators must be fixed *in situ* for long periods of time to establish a satisfactory airway; even then further contracture may be expected. The following case well illustrates many of the points which arise in dealing with such a problem:—

Case 1.

K.E. was brought for treatment at the age of sixteen months with a screw lodged in the lung. The smallest bronchoscope was passed quite easily but the screw could not be dislodged. The foreign body eventually was removed by thoracotomy. Two days after the first bronchoscopy considerable respiratory embarrassment developed and intubation with a small anaesthetic catheter was performed. One suspects that some inflammatory process, perhaps the result of a primary glottic or sub-glottic impaction of the screw, was exaggerated by the instrumentation. Two more attempts were made to extract the screw through the bronchoscope; on each occasion the instrument was passed without difficulty. Owing to increasing respiratory embarrassment tracheotomy was performed on the twenty-third day following the first bronchoscopy. The opening was made through the 3rd, 4th and 5th tracheal rings. The screw was removed two days later. De-cannulation of the trachea was soon followed by severe respiratory difficulty and the patient now, after fourteen months, is still wearing a tracheotomy tube. Having been subjected to repeated dilatation of a sub-glottic cicatricial ring-stenosis and having worn acrylic obturators for

periods of up to six weeks throughout the fourteen months he is able to spend most of the day with the tracheotomy tube completely occluded, yet the airway does not provide sufficient reserve if there be accumulation of any quantity of mucoid exudate, nor is the respiratory blast sufficient to produce more than a very husky little voice. The patient had a paresis of the right vocal cord, but this was almost fully recovered from when last examined. The left cord is quite active.

FIG. I. Acrylic obturators fashioned from O'Dwyer's intubation tubes.

To maintain dilatation of the stricture we have used acrylic obturators (Fig. 1) fashioned from castings of O'Dwyer's tubes. I have used a method of fixation of these obturators which is as effective as the transverse penetrating wires used by Schmiegelow (1938). The idea of penetrating the thyroid cartilages or the walls of the trachea does not commend itself; such trauma of itself may set up further inflammatory reactions. When an obturator fits snugly I have found that a tantalum wire attached below and a silk thread above will hold the implement securely in place. The tantalum wire is passed in through the tracheotomy and is picked up with forceps passed through a bronchoscope. The wire is then fixed to a small hole in the obturator on the anterior aspect of its distal end. The silk thread is drawn through the nose attached to a soft rubber catheter and is then secured to another small hole in the obturator at its upper end. Under direct vision the obturator is passed into the glottis and trachea being guided at the same time from the lower end by gentle traction on the tantalum wire. When in place the wire is fixed securely to the tracheotomy tube. The silk thread is drawn moderately taut and is fixed to the nose bridge with strapping. Care must be taken, especially in little children, that the thread does not exert pressure about the nostril else it will quickly cut into the delicate integument, causing an unsightly injury. The tracheotomy tube must be kept constantly clean with suction and saline swabbings. Daily removal of the tracheotomy tube itself is not essential unless clotted exudates threaten to clog the airway. If changing of the tube is necessary it is only a matter of undoing the tantalum wire and later reinserting its free end through the upper opening of the tracheotomy tube before replacement, and then fixing it securely again. Periodical penicillin therapy and thorough tracheo-bronchial suction cleansing may occasionally be necessary if there are attacks of bronchitis but response is usually rapid and satisfactory. A tantalum wire might also be used instead of the silk thread attached to the upper end of the obturator, however, silk has been found very satisfactory in adapting itself without irritation around the soft palate and into the posterior nasal choana. The somewhat more rigid tantalum might not be quite so well tolerated.

In spite of our efforts, although some measure of success has been achieved, this patient seems to demand that something more must be done. Should we persevere with dilatation, the patient, as he grows, will possibly develop a more adequate airway.

Anxiety to set him talking and to get him back into his home create an urge to try to do better by operation. Our plastic surgeon proposed to insert a pedicled skin graft into the incised constriction in the hope that such a graft would grow with the patient. Unfortunately the piece of skin became detached from its pedicle and was of no use, so we are back where we were except that one now finds the constricting ring can be dilated much more readily—presumably because the split tracheal ring gives way. However, partial contracture still occurs fairly rapidly. Now we are at a stage where the problem is should excision of the constricting ring be undertaken forthwith and the raw

surface be grafted, or should we persevere, perhaps for a number of years with dilatation until, with growth at dimensions, more easily dealt with technically, excision and grafting may be performed within a circumference likely to be of lasting efficiency throughout the patient's life.

It is stated by Jackson that an airway which is used will grow whereas one which is not used will fail to develop further. Most authorities to-day advocate excision of laryngo-tracheal constrictions and free skin grafting of the resultant raw area.

Figi (1947) states "A fundamental on which the success of many plastic procedures depends is the necessity of furnishing a lining membrane in the repair or restoration of the wall of a body cavity. Application of this fundamental principle first introduced by Arbuckle in 1930 to the treatment of cicatricial stenosis of the larynx and trachea, has been one of the greatest advances in the therapy of this condition." Figi, in 1941, reported that excision of scar followed by grafting had been carried out in 27 cases with closure of the tracheotomy in 22. Approach is made through a thyrotomy and, if necessary, the cricoid and tracheal rings also may be divided. A moderately thin split-skin graft is fixed, raw surface outwards around a core of air-foam rubber sponge of appropriate dimensions. This is then immobilized within the larynx by transfixing it with wires passed through the thyroid cartilage and overlying skin. At the end of approximately ten days the sponge rubber core is removed through a laryngoscope. Figi states that the grafts rarely fail to unite and grow freely. Continuous dilatation for a period ranging from a few weeks to approximately a year is nevertheless necessary because of the tendency of the graft to shrink.

Negus (1949) stated that he did not think the results of continuous dilatation were good and that, in his experience, excision of scar tissue and skin grafting was generally the right treatment although the cases which he then showed had nevertheless been unable to dispense with the tracheotomy tube.

Kilner (1949), the plastic surgeon, on the same occasion presented several cases and reported that, in all, the stenosis recurred very soon after the skin grafting operation. He discussed reasons for this. He stressed the need for meticulous excision of all scar tissue yet voiced the fear and risk of perforating the air passage. The graft should be thin and of ample dimensions so as to more than cover the raw surface and it must be kept immobile with a suitable "form." He suggested pink dental wax encased in a finger cot since the wax at body temperature moulds itself to any irregularities in the raw surface. Since free skin grafts contract very rapidly the mould should be kept in position for at least six weeks. Even then intermittent dilatation may still be necessary.

These authorities then all confirm the view that an active policy of careful excision of scar tissue and skin grafting is the correct procedure. It is to be realized, however, that the surgical operation alone will not once and for all cure the stenosis. Patient dilatation after the grafting still is necessary; however, a speedier and more lasting cure is to be expected from operation plus dilatation than from dilatation alone.

In a recent paper Woodward (1950) has reported success with sharp submucous dissection of the cicatrized area, the mucosa being preserved as much as possible thus avoiding the need for skin grafting. This is followed by the immediate insertion of acrylic tubes duplicated from O'Dwyer's intubation tubes. These are fixed *in situ* with tantalum or steel wires for periods of two to six months and are then removed perorally. The wires are passed through the thyroid cartilages and are then bent down closely and remain in this subcutaneous position. They hold the tube in place effectively yet the free ends of the wires will trail when the mould is removed.

Case 2.

Miss J. S. suffered a bullet wound of the neck and larynx in 1943 (Fig. II). She was treated in New Zealand and had already submitted to the passage of laryngeal dilators and in dwelling core moulds and had had a laryngofissure operation but was without an exact record of what had then been

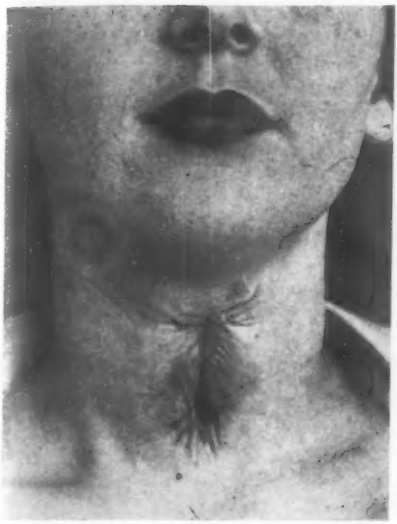

FIG. II. Miss J. S. before operation for laryngeal stenosis. Tracheostomy opening is visible, and neck scarring of injury and previous operations is evident.

done. She was wearing a tracheotomy tube. She had a small but inadequate laryngeal airway; her voice was no more than a hoarse whisper. Direct laryngoscopy revealed web-like adhesions across the anterior glottic commissure and below the glottis. An approach was made to the interior of the larynx by laryngofissure. The lumen was found to be very shallow and the lining was smooth and tight looking. The vocal cords were flattened and moved very little, appearing to be paralyzed and relatively fixed. Web-like bands and fibrous constrictions were excised so that the lumen appeared to be well restored. We then followed approximately a plan described by Erich (1945) of the Mayo Clinic. An appropriate length of rubber tubing, having a diameter which fitted closely to the restored airway, was selected. Using dental stent a sort of handle to the intra-laryngeal tube was designed.

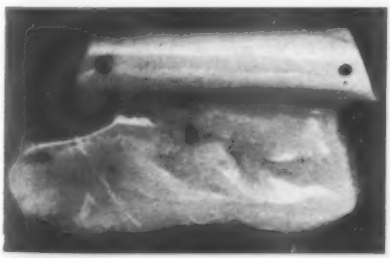

FIG. III. Acrylic cast used to maintain laryngeal lumen and an open thyrotomy.

This handle projected through the lower part of the thyrotomy and neck incision and fitted closely down against the upper margin of the tracheotomy tube. The handle of dental stent and the length of rubber tubing were then removed and the combined piece was then cast in acrylic material (Fig. III). A sheet of split-skin was next fastened with its raw surface outwards about a piece of sponge rubber which had been cut to fit the restored laryngo-tracheal lumen. This skin-bearing "form" was fixed inside the larynx and the overlying soft parts were lightly sutured across it. After fourteen days the wound was partly reopened and the acrylic cast was placed within the laryngo-tracheal lumen. This obturator was worn by the patient, with occasional changes for a period of approximately six months. The effect was to keep the thyrotomy partly open and to form a deep gutter comprising the laryngo-tracheal lumen (Fig. IV). This was then closed by Mr. K. Starr so as to provide a skin lining for the anterior aspect of the laryngeal cavity. Although the patient appeared subsequently to have an adequate laryngeal lumen she refused to abandon the tracheotomy tube.

FIG. IV. Miss J. S. after obturator had been worn six months following skin grafting of the laryngeal walls. Note now the patent laryngeal airway. This was subsequently covered over by plastic operation.

At the beginning I mentioned that, apart from cicatricial stenosis, paralysis or fixation of the vocal cords may co-exist, thus providing, in addition, an inadequate glottic airway. Such a condition should always be

looked for. When present it is obvious that no amount of passive dilatation will overcome this element of the obstruction. In such instances surgical abduction and fixation of the arytaenoid cartilage, employing one of the modifications of King's operation may be called for either alone, or in addition to the measures which have been described for the cure of cicatricial stenosis.

Case 3.

Mrs. C., aged 56, had healed pulmonary tuberculosis with gross fibrosis in the lungs and abductor laryngeal paresis, presumably from involvement of the recurrent nerves in the fibrotic process. She had auricular fibrillation and was subject to life-threatening attacks of glottic spasm. A preliminary tracheotomy was performed and for three weeks cardiac stabilizing measures were employed. At the end of that time right arytaenoidopexy, employing the technique of de Graaf Woodman (1948), was carried out.

Successful glottic widening was achieved so that the patient has since been able to dispense with the tracheotomy and is able to lead a comfortable active existence.

I have not intended to describe something new in the management of cases of stenosis of the larynx and trachea, nor have I been able to report any very large or brilliant series of successes in this field. Only rarely will a very large experience with these cases fall to the lot of one man. The object has been to collect together the most instructive reports from the literature and to place the teachings therefrom alongside personal observations and lessons gained from a selected few out of a small series of cases.

The lessons to be learned appear to be clear. Prophylactic measures in the form of early and adequate internal splinting with core moulds should always be adopted after any severe laryngo-tracheal injury. For established stenosis careful excision of scar tissue, with the preservation of the mucosa where possible, or followed by adequate lining of the denuded cavity with split skin grafts, is usually necessary. Even after excision of contractures and grafting the problem is by no means fully resolved. Patient and repeated dilatation is often still required for quite a long period of time.

It is still uncertain whether excision and grafting should be performed early in the case of infants such as the one which I have described or whether it is wiser to employ intermittent dilatation so as to maintain a partially functioning airway until some natural growth has taken place. The importance of co-existence of abductor paralysis or arytaenoid fixation is noted and what appears to be the simplest and most effective method of correction is briefly mentioned. Time has not permitted description of methods to restore collapsed or lost portions of the laryngo-tracheal framework although it is realized that such may complicate the problem.

REFERENCES.

ARBUCKLE, M. F. (1930) *Ann. Otol., etc., St. Louis*, vol. 39, page 134.

ERICH, J. B. (1945), *Arch. Otolaryng., Chicago*, vol. 41, page 343.

FIGI, F. A. (1947), *Sth. med. J. Bgham. Ala.*, vol. 40, page 17.

JACKSON, C. and JACKSON, C. L. (1945), "Diseases of the nose, throat and ear." Philadelphia, Saunders, pages 493, 552-558.

NEGUS, V. E., KILNER, T. P. *et alii* (1949), *Proc. R. Soc. Med.*, vol. 42, page 981.

SCHMEIGELOW, E. (1938), *J. Laryng.*, vol. 53, page 1.

WOODMAN, de Graaf (1948), *Ann. Otol., etc., St. Louis*, vol. 57, page 695.

WOODWARD, F. D. (1950), *Ann. Otol., etc., St. Louis*, vol. 59, page 488.

TENDON REPAIR IN THE HAND — A SUPPLEMENTARY PAPER.

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IN Brisbane two years ago, one of the authors (A. R. W.) gave some account of our experience in the modern approach to repair of flexor tendons, and showed the standard of results in a series of 71 repairs in 54 cases (Rank and Wakefield, 1950). This paper must be regarded as a supplement to that.

After experience with a further 66 repairs of cut flexor tendons in 62 cases, as well as reiterating the principles already enunciated, we now feel in a stronger position to make more positive statements in regard to case selection and technique and to elucidate certain points on which we were then vague or undecided. These are set out briefly as follows.

A. General.

1. *When both tendons are cut in the digital sheath area,* primary direct repair of the profundus tendon should be abandoned as a procedure of choice in adults, even with the clean cut or "tidy" type of wound. We say this despite some excellent results of primary direct repair in individual cases. It does not apply in children. It does not apply to the flexor pollicis longus tendon. We appreciate, however, that surgery is not static and future developments of knowledge and practice might well alter this attitude.

Variation in the results of primary direct repair of the profundus tendon in the finger largely depend on the amount of overlying soft tissue at the site of repair. In general, the best results have been in the region of the middle of the proximal phalanx and not beneath the inter-phalangeal creases—though there have been exceptions to this.

Elective secondary tendon grafting is the procedure of choice in repairing cut flexor tendons between the metacarpo-phalangeal joint and the sublimis insertion. These are best done not in relation to some arbitrary time period after primary wound closure, but as soon as the healed wound has softened. Thus their timely use and effect is largely conditioned by the standard of primary wound closure.

The results in our last series of consecutive cases are detailed in Table 1. There is no reason other than that of surgical expediency and convenience for doing flexor tendon grafts as secondary rather than as primary procedures in otherwise favourable cases. We have, on occasions, done primary grafts but here is one of many examples we come across where organization of surgical practice is unable to keep pace with technical progress. We are all, to some extent, hamstrung by the system under which we work, for we must be emphatic that it is quite unfair to a patient to carry out such a procedure as a free tendon graft except under proper conditions of both personnel and material.

2. *When the profundus tendon only is cut* — i.e., injuries distal to the sublimis bifurcation, we would repair the profundus tendon as a primary procedure only if the cut in the profundus tendon is well clear of the sublimis insertion. At the worst nothing will be lost in so doing. In cases which present secondarily as they commonly do, we would only do a secondary repair of the profundus tendon if the section is right near its ultimate insertion.

We must accept the fact that in adults the point of suture adhers to its surrounds. If this is proximal to the distal joint, active flexion of that joint cannot generally be expected after secondary repair. The alternative which presents in such cases is either to leave well alone and accept the disability of function as it stands, perhaps fixing the distal joint in useful flexion, or else to insert a free palmaris graft from lumbrical origin to profundus insertion. This may or may not involve removal of the sublimis, depending on the amount of local damage.

TABLE 1.

TENDON REPAIRS IN INCISED WOUNDS OF PALM AND FINGERS

66 DIGITS IN 62 PATIENTS

THUMB

CUT AT ANY POINT DISTAL TO TRANSVERSE CARPAL LIGT.

12 DIGITS IN 12 PATIENTS

	TOTAL	Primy. Suture	Secdy. Suture	Secdy. Graft
GOOD (better than 45° active I.P. flexion)	9	3	—	6
MODERATE (20°–45°)	2	1	1	—
POOR (Less than 20°)	1	—	—	1

FINGERS

54 DIGITS IN 50 PATIENTS

BOTH TENDONS IN THE PALM

6 DIGITS IN 6 PATIENTS

	TOTAL	Primy. Suture	Secdy. Suture	Secdy. Graft
GOOD (90–100% finger flexion. Finger tip to palm)	5	1	2	2
MODERATE (50–80% „ „ „)	1	—	—	1
POOR (Less than 50% „)	—	—	—	—

BOTH TENDONS IN THE FINGER

33 DIGITS IN 32 PATIENTS

	TOTAL	Primy. Suture	Secdy. Suture	Secdy. Graft
GOOD (90–100% finger flexion. Finger tip to palm)	18	6	—	12
MODERATE (50–80% „ „ „)	12	1	1	10
POOR (Less than 50% „)	3	—	1	2

PROFUNDUS ALONE IN FINGER

15 DIGITS IN 12 PATIENTS

	TOTAL	Primy. Suture	Secdy. Suture	Graft with Sublimis Intact
GOOD (Finger tip to palm and better than 30° flexion and joint)	12	6	2	4
MODERATE (Less than 30° active flexion and joint)	2	—	1	1
POOR (No flexion and joint)	1	—	1	—

We have had no real success whenever we have compromised on this attitude. The decision must be made after lucid explanation to the patient and depends largely on the existing degree of embarrassment to the function of the intact sublimis tendon which is caused when the profundus tendon retracts through its arch. The degree of this retraction depends largely on whether or not the vincula is intact.

3. *With cuts of both tendons at the proximal end of the digital sheath*—i.e., in the distal palm—we have often been tempted in error to do a direct profundus suture and cut away the anterior sheath in this area. Results of this procedure in adults have been poor and in no way compare with those of a free tendon graft.

It seems we should never compromise in our approach to the injuries of flexor tendons in the digital theca.

B. TECHNICAL.

In addition to those already indicated in our previous paper, some further technical points of value in the tendon grafting operation merit consideration, while some points already stated need further explanation.

1. *The exposure* of the operative field in the finger deserves emphasis. The finger incision is designed in such a way that a flap is turned back, *anterior* to the digital nerve. This means that the edge of the flap is cut thin until the nerve is cleared. We have frequently noted exposure attempts made from a lateral incision and dissection deep to the digital nerve which makes the

finesse of the tendon grafting operation unnecessarily difficult. The flap exposure, as illustrated, is not generally used, if at all, by other surgeons in this field with whose work we are familiar.

2. *The importance of paratenon.*— We have often demonstrated how palmaris tendon grafts have a considerable excursion through their paratenon which rapidly fixes to surrounds. If there is no paratenon, they can only act by pulling on surrounding soft tissue to which the tendon becomes adherent. It is of prime importance, therefore, that grafts be inserted with their own paratenon intact. This is why the outlook is immediately diminished if no palmaris longus tendon is available. It is for this reason, too, that we continue to make a long forearm incision to remove the tendon and paratenon carefully. It is known that tendons of smaller calibre do better as grafts than larger tendons. The extensor longus tendon to one of the toes we regard as second donor choice but the available length of the sublimis tendon to the affected finger is a very bad third choice.

When the graft is passed through the small retained loops of the digital theca, special care must be taken not to concertina the paratenon on to one end of the tendon. As the graft is usually inserted from the finger proximally, it is a worthwhile precaution to draw the paratenon sleeve-like well on to the proximal end of the graft. This prevents adhesion of the tendon here, and allows a maximum range of movement of the graft in its paratenon during the flexion movement. It is equally important that paratenon extend right to the distal suture point.

3. *The distal junction of the graft.*—This must be distal to the distal inter-phalangeal joint. Only the shortest stump of profundus tendon can be left, if independent active flexion of this joint is to be expected.

In many of our early cases a good flexion range in the proximal joint was obtained with little or none at the distal joint. This was because we had left too long a stump of the profundus. The effective distal insertion is at the point of suture of the graft. This is doubtless why, in some overseas centres which handle these cases in numbers, the graft is attached directly to bone. In our opinion this causes extra technical difficulties, and it is unnecessary provided only a very short stump of profundus is left.

4. *The proximal junction of the graft.* A further mistake we have often noted is that the proximal junction of the graft is too far distal in the palm. Here it becomes adherent in the region of the distal palmar crease to the skin and/or proximal end of the digital sheath. This mistake, of course, renders the whole purpose of a tendon graft null and void. The proximal suture point must be deep in the palm where it can be easily enveloped by the lumbrical muscle.

5. *The tension of the graft.* The tension in any reconstituted tendon should reproduce the normal tendon tension and finger posture for that particular finger in the relaxed position. Proper appreciation of normal tendon tension is important, not only to repair, but also in diagnosis where abnormal finger posture and tension is the best guide to tendon section and often, indeed, the only reliable objective sign of a cut tendon.

6. *Suture materials.* We must realize and appreciate that there are diverse paths to success. Our use of silk for both ends of the graft might apparently contradict modern overseas practice where wire is generally used, especially for the distal end. It should be noted, however, that where this is done it is the usual practice to fix this end of the graft direct to bone, and not to a short stump of profundus tendon which we regard just as effective, quicker, and without the hazards of transfixing the distal phalanx in the very limited space between joint structure and nail bed. Silk is certainly easier to use and handle than wire and in our hands has been satisfactory. Our experience with the "pull out" wire technique was uncertain. We are unimpressed by both its rationale and technique. On occasions, however, where there is no stump of profundus tendon we do use wire to fix the graft to bone—but do not remove it, i.e., it is a closed technique.

C. SPECIAL CONSIDERATION.

Nerve injuries as commonly associated with tendon injuries in the hand.

For all clean cut or "tidy" hand injuries we uphold the important principle of primary repair of divided structures, whether tendon or nerve or both, provided only that necessary personnel and facilities are available

and the patient's general condition would not be prejudiced. Though as already stated we make one regional exception to this principle in the case of tendons, we concede no exception in the case of nerve injury. We are well aware that this is contrary to common British teaching (Parkes, 1949) where delayed repair for such nerve injuries is generally advocated for various reasons, earliest and most powerful of which was fear of sepsis. Until a few years ago this was valid argument, but to-day, if ordinary surgical principles are properly respected, it no longer holds. In the past seven years we have had no single case of primary tendon or nerve repair which has failed because of sepsis. Superior results have lately been claimed from delayed repair of nerve injuries with the argument that proximal and distal damage and reaction can neither be properly assessed nor catered for at a primary operation. We are well aware of Seddon's (1949) work in this regard. It must be remembered, however, that we are here considering clean incised wounds most of which have been inflicted by knives, glass, razor blades, and the like, in a single rapid action, and there is little reason to believe that the amount of nerve damage is appreciably greater than that which would follow at a second operation some weeks later when a surgeon exposes, isolates, and again sections the nerve in the operation of delayed repair.

Indeed, it appears to us there is only one valid argument which can be raised for delayed nerve repair in these cases—that of expediency which has been elaborated on the basis of a war-time experience. We would be in entire agreement that a decision for delayed repair under proper conditions would be preferable to any enforcement of the principle of primary repair at all costs, if there were not requisite facilities and personnel available to deal properly with the problem. However, such can hardly be introduced as a legitimate argument when considering only surgical indications nor has it any force in any case under modern civil conditions of proper surgical centres and rapid transport.

The management of combined nerve and tendon injuries in the various situations on the palmar aspect of the hand can be set out as follows.

(a) *In the fingers*—more often than not one or both digital nerves are cut with the tendons. In this situation, tendon damage overrides the nerve in importance especially when, as is commonly found, one nerve only is cut. Nevertheless, the nerves must be respected and dealt with on their merits. There can be no excuse for overlooking them, for an anaesthetic finger is no small handicap.

Spontaneous nerve regeneration is common enough in the distal half of the finger but is much less common when the main nerve trunks are divided near the base of the finger, especially when the ends are further separated by the exposures and manipulations required to deal with the tendons. Digital nerves are structures of appreciable size and irrespective of what is done in regard to any associated tendon injury, they should be repaired primarily in all cases. They are nerves pure in type and they do well.

(b) *In the palm*, i.e., between the distal end of the transverse carpal ligament and the region of the metacarpo-phalangeal joint. Here the principle of primary repair covers all structures except that a divided flexor sublimis tendon can be disregarded. On the ulnar side of the hand, injuries at this level commonly do not involve the long flexor tendons but frequently extend through the hypothenar muscles to involve the terminal branches of the ulnar nerve. The superficial portion of this nerve and its branches are easily identified and sutured but isolation of the distal segment of the deep portion supplying the important small muscles often involves difficult and tedious dissection in the depths of the palm through the origin of the hypothenar muscles. Primary repair of this nerve is of particular importance for its exposure through scar as a secondary procedure is doubly difficult and may be well nigh impossible.

(c) *At the wrist.* Section of one or both of the main nerves is the rule with the common types of composite injury caused by such as the suicide cut or a fall with the outstretched hand through a glass panel. Here again, and even more strongly, do we advocate repair of these nerves at the primary operation along with the tendons. Whatever the merits or demerits of delayed repair may

be, if the best results from the injury as a whole are expected, it is essential that the tendons and nerves be repaired at the same operation. Hand surgery is reduced to its worst if indications are based on separate considerations of any particular structure. Anyone who deals with hand injuries must be competent with all aspects of reparative surgery. Nothing could be more prejudicial to the results of a tendon repair than to carry out a second operation on the nerves in the region—as is generally advocated—and then to reconstitute immobilization at the very time when active mobilization is necessary to restore finger movement and prevent flexion contraction. Admittedly, primary operation might become a long tedious procedure at an inconvenient time but we are in no doubt that it is the procedure of choice and the results are among the most gratifying in hand surgery.

The after-care problem, when tendons and major nerves are injured simultaneously at the wrist, has particular difficulties. Chief of these is due to the absence of effective antagonists to the repaired long flexor tendons because of small muscle paralysis. This, if uncontrolled, invariably leads to gross flexion contracture of the affected fingers which will be fixed and intractable by the time nerve recovery eventually restores the small muscles. If this state of affairs is anticipated, and a traction extension splint provided after about five or six weeks to substitute for the finger extension mechanism, tendon contracture can be avoided. Active flexion can then be continued against the active pull of such a splint. Splints of this principle are of great use for all postural changes associated with nerve and tendon injuries to permit of controlled function during the period of nerve regeneration.

SUMMARY.

The vastly improved results in the latter series of cases as compared with those previously presented, we attribute mainly to the following:—

(a) A better knowledge of what cases have no prospect of any improvement. This does not mean that we discard any cases where there is any prospect of success whatever. A good condition of the joints and absence of scar embarrassment are essential to success.

(b) A more patient attitude in waiting until any scar residuum, which is not going to be replaced, has softened.

(c) A more practised and standardized technique which, if done in proper sequence, permits of a quicker, more orderly and less traumatic procedure which, in the case of a single finger, can be completed under tourniquet avascularity.

(d) A personal conduct of all phases of treatment.

In conclusion, we consider that a stage has now been reached when we can tell patients with ordinary confidence what can or cannot be achieved by operations of tendon repair. Moreover, in general consideration of tendon repair in the hand we would now make this statement, which might surprise many — In relation to the criteria of normal function, our worst results from cut tendons are where these injuries involve not the flexor tendons on the front of the finger, but the extensor tendons on the back of the finger. This statement is made with sound reason which we will discuss elsewhere.

REFERENCES.

PARKES, A. (1949), In "British Surgical Practice," vol. 6. London. Butterworth Medical Publication.

RANK, B. K. and WAKEFIELD, A. R. (1950). *Aust. N.Z.J. Surg.*, vol. 19, page 232.

SEDDON, H. J. (1949), *Proc. Roy. Soc. Med.*, vol. 42, page 427.

ACHALASIA OF THE CARDIA.

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As a result of its inexplicable aetiology, unceasing controversy continues in reference to the terminology of this disease. None will deny, however, that it is a concise clinical entity with well recognized pathological changes. The contentious aetiology, the pathology, and the diagnosis are more widely appreciated by the profession than the treatment with which this paper is largely concerned. Achalasia can be considered, according to the radiological changes, in three degrees; not that the disease can be sub-divided, but the type of treatment indicated and the resultant prognosis bear some relationship to these stages of progress. The degrees are as follows:

(1) Constriction at the cardia with irregular contraction in the lower two-thirds and dilatation in the upper third.

(2) The whole oesophagus dilated, but the lower two-thirds still showing some movement.

(3) The constriction still present, but the oesophagus is represented by a grossly dilated inert bag.

The diagnosis can usually be made on clinical grounds alone with confirmation by a barium swallow examination. There may be times, however, when the radiologist finds it difficult to be dogmatic; on such occasions, the clinical, radiological and oesophagoscopical examinations, when considered together, rarely fail to make an accurate diagnosis. The diagnosis of achalasia cannot be mentioned without referring to the pulmonary complications because they may furnish the presenting symptoms. These take the form of "spillover" lesions in one or other lung or more rarely as a collapse resulting from the enlarged oesophagus pressing on a main bronchus. Suffice it to say that if adequate treatment of the primary disease is instituted, the secondary lesions usually resolve satisfactorily.

Active treatment should be instituted as soon as the disease is recognized, and if adequate, a high proportion of "cures" will result.

Many forms of treatment have been recommended in the past, but unfortunately for the suffering patient the past is too often prolonged into the present. Treatment such as excision of strips of oesophagus, oesophagoplication, division of the crura, vagotomy, sympathectomy and others has long since been given up, but there is still a widespread lack of appreciation of proven treatment which is available to-day.

Psychological stress is often associated with the onset both of the disease as a whole or of a so-called "attack," however, it is accepted that psychiatric treatment is useless. It is therefore unfortunate that some clinicians persist in this form of treatment. Barrett (1950) considers that psychiatric treatment only adds insult to injury, which contention I heartily endorse, and furthermore, it is one of those delightfully long and vague forms of therapy which only serve to delay the institution of adequate treatment.

The majority of so-called anti-spasmodic drugs is of fleeting value only. Trinitrin tablets do allow the oesophagus to relax and the patient may have a rough passage through a meal with the aid of several tablets, but the hot flushes, headache and other side effects from taking trinitrin are such that it is not practical to consider this as a form of treatment. However, the exhibition of this drug may assist in clearing the oesophagus in an established case in preparation for oesophagoscopy.

The 17th century treatment using the mercury-loaded bougie is still widely used and undoubtedly gives periods of temporary relief, but many patients only suffer this abominable instrument because they are led to believe that other treatment is dangerous or even worse, that this is the treatment of choice. A form of treatment which is so temporary in its benefit and at the

same time disgusting to the patient and even more repugnant to the members of his family, should be abandoned.

The Mikulicz operation which is essentially trans-gastric digital dilatation, whilst successful on occasions, has obvious drawbacks, particularly if it has to be repeated, and furthermore has too high a mortality, even in experienced hands, to recommend it.

It is rather odd that a corollary of this method of treatment has proved so successful that it now becomes the method of choice in most cases, namely hydrostatic dilatation through the oesophagoscope.

It is, of course, essential that the instrument should be placed accurately in the narrowed segment and dilated adequately. In first and second degree disease, this manoeuvre is nearly always possible and results in a "cure" in approximately 80 per cent. of cases. In advanced second and third degree disease, it may not be possible to find the cardiac orifice, or it may be out of reach of the standard oesophagoscopes, hence hydrostatic dilatation is out of the question.

I first used this procedure just two years ago, since when I have treated 7 patients with complete relief in 5, almost complete relief in one and one failure. Admittedly the period of time that has elapsed is too short for dogmatic conclusions to be drawn as to permanent "cure," but when one considers that the patient's ability to eat normally is restored within the day, and is likely to remain normal, then the treatment seems to be worthwhile.

Of the 7, 3 were completely relieved after one treatment and two after three treatments. The one failure was a very under-sized boy aged 14, who failed to respond to three treatments, but was cured by a trans-thoracic Heller-type operation. The seventh case has been dilated three times. Following the first two treatments, he could eat normal meals without difficulty and gained 3 stone in weight, but he had some regurgitation of food when in bed, thereby indicating that he had some residue. His cardiac opening has been dilated again, apparently with complete relief, but the time is too short for any conclusion to be drawn, hence he is not claimed as a cure.

The patients are prepared for dilatation by oesophageal washouts if necessary, either intermittently or by periods with Wangensteen's apparatus and allowing the patient to drink copiously of clear fluids at the same time. In others, diet is restricted for several days prior to dilatation. The anaesthetic used is pentothal, curare and endotracheal trilene. Whereas it is not necessary to employ intubation for diagnostic oesophagoscopy, an assured airway seems essential for a procedure which takes about twenty-five to thirty-five minutes to complete. A full lumen Negus oesophagoscope is passed and the oesophagus cleared of debris. Gum elastic bougies up to a large size are passed into the stomach to establish the patency of the lumen. Then three or four attempts at hydrostatic dilatation are made at slightly varying levels to ensure that at least one is at the correct site.

The instrument used consists of a rubber tube with a metal core. At its distal end are grooves for tying on a rubber bag over which is fixed a mosquito net bag about 2 inches in diameter when inflated. When first purchased, this instrument only had rubber bags for fixation at the distal end, but it was felt that the stretching effect at the narrowed segment was being lost because the bag dilated in an aneurysmal manner into the stomach. To obviate this, the rubber bag was covered with a net bag of the desired shape and when this is fully distended, it dilates the oesophagus to the desired degree without risk of aneurysmal swelling of the bag into the stomach cavity. An accurate estimate of the amount of stretching can be obtained by testing the instrument with a known quantity of water immediately before use.

If this treatment fails after 3 attempts, then oesophago-cardio-myotomy as practised by Heller or by the trans-thoracic route should be performed without delay. There will always be supporters of both approaches to the oesophago-gastric junction, and doubtless the facility one possesses in one or other approach will colour one's opinion. It seems of paramount importance that the section of gut on which the myotomy is to be performed should be readily accessible, unrestricted, unstretched and under the best

illumination possible—all of which conditions are best fulfilled by the trans-thoracic approach.

I have seen this operation performed a number of times and have done it myself but once, and I would say that it is probably the easiest operation that falls to the lot of the thoracic surgeon.

It might be argued that if myotomy is so successful, which in fact it is, why attempt hydrostatic dilatation at all? In spite of this it is felt that the results being obtained by adequate hydrostatic dilatation are so good and the disturbance to the patient of some two days in hospital, or as Allison claims, one attendance at the out-patient's department, are so minimal that dilatation should be attempted first in all suitable cases.

In recapitulating the outline of treatment, myotomy should be recommended when there is

(1) Failure of hydrostatic dilatation either (a) after trial
or (b) technically impossible as in late second and third degree disease.

(2) In children.

Some authorities are still advocating the use of oesophago-gastrostomy for the disease in its advanced forms. Fortunately such cases are rare, and with our present knowledge of treatment should become even more so. Oesophago-gastrostomy could be used if all other measures failed, but Barrett in England and Clagett in America, who were strong supporters of this operation, have completely denounced their former beliefs as a result of the dire side effects from regurgitation of gastric contents. This, of course, is the experience of everyone who has performed this operation often enough, hence it should only be employed as a life-saving measure, as is the case in cancer surgery.

The word "cure" which has been so freely used requires further explanation. When "cure" is mentioned, it is quoted in inverted commas because "cure" in these cases is a symptomatic one as a result of which the patient can eat normally. The radiological picture after treatment may be disappointing, and even in patients who have been symptomatically "cured" for years, many still show a significant enlargement of the oesophagus on X-ray examination. However, the passage of food into the stomach in a symptomatically "cured" patient is probably within normal limits. I imagine that the oesophagus will only return to normal in first degree cases because in second and third degree cases. changes have taken place in the oesophageal walls which are irreversible.

My experience is limited to 10 cases, 7 of whom have been treated by hydrostatic dilatation, 2 of the remaining cases were not directly under my care and received other treatment, and one having been treated by oesophago-gastrostomy some two years before, will not be included.

To conclude—I have chosen three cases from this series because they illustrate some of the principles I have outlined above.

Case 1.

Mrs. G.C., aged 37, was the first patient I treated with the hydrostatic dilator. She was first seen in April, 1949, with a history of having had difficulty with swallowing for the previous nineteen months. During this time she had vomited during or after practically every meal. She derived some relief by eating her meals standing up and walking about, but she was never sufficiently free from symptoms to allow her to eat in hotels or restaurants because of the embarrassment which arose from regurgitation and vomiting. She had derived slight benefit from trinitrin tablets and managed to consume her

FIG. I. Pre-operative X-ray of Case I showing typical late first degree type achalasia.

meals by taking a series of tablets. When first seen she could neither eat nor drink without the assistance of these tablets. She was of a nervous temperament and had lost approximately one stone in weight in recent months, with obvious deterioration of her mental and general physical condition.

FIG. II. Post-operative X-ray of Case I taken six months after treatment showing considerable reduction in the size of the oesophagus and the presence of waves of contraction.

X-ray screening of her oesophagus revealed a typical achalasia (Fig. I). She derived no benefit whatsoever from the first two treatments and I realize now that this was due to my inefficiency rather than any faults of this method of treatment—and partly due to the fact that I had not modified the dilator for the first occasion. Following the third treatment, she had medium relief and for several months she could eat her meals normally, but occasionally she was aware of some delay of the passage of food through her oesophagus. However, this passed off and she now eats all her meals without any difficulty whatsoever (Fig. II).

Case 2.

Dr. P.W., aged 42, gave a history of having had some difficulty in swallowing his food since November, 1944. He had a sense of obstruction at the lower end of his oesophagus and was forced to eat a restricted diet and to consume his food at an abnormally slow rate. He had noticed that his

FIG. III. Pre-operative X-ray of Case 2.

FIG. IV. Post-operative X-ray of Case 2 showing reduction in size of the oesophagus and the rapid passage of barium into the stomach.

symptoms were aggravated by worry. He obtained an appointment in Australia and arrived in October, 1950. His arrival was marked by unexpected worry and mental stress and from that day his oesophageal obstruction became practically absolute and he had been unable to eat any normal meals and kept

himself alive on a very restricted fluid diet (Fig. III). During the six weeks before his treatment was instituted, he had lost over a stone in weight. He is now eating meals normally and has regained his previous weight (Fig. IV).

Case 3.

This patient was a thin, miserable, under-sized boy of 14 with a history of having had difficulty with swallowing his food for approximately four years. He was actually admitted to hospital on account of a severe "spillover" lesion which caused a right-sided pneumonia. This was particularly

FIG. V. Pre-operative X-ray of Case 3 showing gross dilatation of the oesophagus, also illustrating the presence of small secondary contraction waves.

interesting in that a brother had died from this same complaint ten years previously. At the time of his admission, he was too sick to consider treatment of his oesophagus, in fact it was two months before the pneumonic condition was sufficiently under control to allow active treatment for his achalasia (Fig V). I attempted hydrostatic dilatation on three occasions without any relief. This was attributed to the fact that a small oesophagoscope had to be used and it was not possible to place the hydrostatic dilator sufficiently accurately to allow adequate dilatation. As a result of the failure of this treatment, I performed trans-thoracic Heller-type operation in July, 1950, with dramatic relief, the patient being able to eat normally from the day following his operation. When last seen, he had gained 1½ stone in weight. His mother stated that he was eating the same food as the rest of the family without any difficulty, and he had had no further trouble from his chronic pneumonitis, which radiologically had shown considerable resolution (Fig. VI).

FIG. VI. Post-operative X-ray three months after the completion of treatment showing the normal appearance of the oesophagus. This film also shows the residual fibrosis in the right lung caused by the "spillover" pneumonia.

REFERENCES.

BARRETT, N. R. (1950), *Proc. Roy. Soc. Med.*, vol. 43, page 421.

FRITZ, J. M., CLARK, D. E. and ADAMS, W. E. (1951), *Surg. Clin. N. Amer.*, vol. 31, page 173.

GILL, D. C. and CHILD, C. G. (1948), *Surgery*, vol. 23, page 571.

KAY, E. B. (1948), *Ann. Surg.*, vol. 127, page 34.

MAINGOT, R. (1944), *Postgrad. med. J.*, vol. 20, page 278.

TEMPLETON, F. E. (1948), *Gastroenterology*, vol. 10, page 96.

VINSON, P. P. (1948), *Postgrad Med.*, vol. 3, page 13.

WULFF, H. B. and MALM, A. (1949), *Thorax*, vol. 4, page 243.

FRACTURES IN THE NEIGHBOURHOOD OF THE SHOULDER JOINT.*

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THE bugbear of the stiff shoulder following injury is always with us. A great deal of unnecessary stiffness following fractures in this region can be avoided by adherence to certain primary principles chief of which is early movement. The intention of this present communication is not to recapitulate in detail the clinical features and treatment of every injury in this region, but rather to draw attention to certain features of injuries in this region which by no means always receive the attention they deserve.

Fractures of the Greater Tuberosity of the Humerus.

Fractures of the greater tuberosity of the humerus are generally regarded but lightly. The degree of displacement is non-existent or slight, union is rapid and speedy restoration of function is anticipated though not always attained. Sometimes the fragment is a large one, and includes portion of the articular surface of the head of the humerus. Generally these fractures should be treated with the limb placed on an abduction splint with the shoulder at an angle of 90 degrees and movement commenced within ten days. An exception to this rule is the patient in whom this fracture has occurred as a complication of a dislocation of the shoulder joint, inasmuch as the assumption of the abducted position may lead to re-dislocation. The object in the forefront of our minds in treating all shoulder-joint injuries is to prevent avoidable joint stiffness. We do this by employing an abduction splint, except when there is some special contra-indication to its use. The general rule holds good that the shoulder splinted in abduction is less likely to become stiff, and such stiffness as does occur, is more likely to be readily overcome, than when the limb is kept by the side of the body. Two special types of greater tuberosity fracture deserves individual mention. Sometimes a tuberosity fracture occurs in association with the common anterior dislocation of the shoulder joint, and when the dislocation is reduced, the tuberosity is left behind lying below the inferior margin of the glenoid where it commonly causes pressure upon the great nerve trunks. Should a careless practitioner be satisfied with his reduction of the dislocation and omit the necessary post-reduction X-ray examination, this complication may escape his notice. The fragment must, of course, be removed operatively, but if its presence has not been detected until two or three weeks later, it must be extricated with great care to avoid damage to the axillary vein or great nerves.

Another rare fracture is the small avulsion fracture of the greater tuberosity in which a fragment no bigger and no thicker than a finger nail is avulsed by the pull of the tendon of the supraspinatus muscle, and retracts widely beneath the acromion and above the highest part of the articular surface of the humeral head, and with each successive day's delay the amount of retraction increases. It is frequently held that all that is necessary is to abduct and externally rotate the humerus, and that this will succeed in reapplying the main body of the humerus to the avulsed fragment which is itself incapable of control. This may be true in patients who are seen, X-rayed and diagnosed early. It is quite ineffective when the injury is two or three weeks old, before the patient comes under treatment. In such case considerable permanent disability is inevitable. The fragment must be removed, because it furnishes a mechanical block to movement. One cannot pull it down and replace it at the site of its original attachment. The insertion of the supraspinatus tendon is sacrificed with permanent loss of the power of elevation.

The common and important fracture in this region is the fracture of the neck of the humerus. It is usual to divide these into adduction and abduction fractures. A further

*Read at the Annual General Meeting, Sydney, June, 1951.

sub-heading is of greater importance, namely impacted or non-impacted fractures. Of the two types the adduction and abduction fracture, the latter in my experience is by far the commoner, particularly in adults. In the adduction fracture, the shaft lies in a position of adduction in relation to the head, that is with angular convexity laterally. They are usually impacted and the treatment is obvious. Apply traction and abduction and immobilise in an abduction splint for three weeks before commencing movement. Union is usually rapid. This is a common fracture in childhood, and in addition to the above-mentioned displacement, there is usually well marked forward bodily displacement of the shaft in relation to the head. In the common absence of a lateral X-ray, this element of the displacement remains undetected and unreduced. It is masked by the general swelling and only becomes apparent after union has occurred. Fortunately the damage is aesthetic only. In young children this fracture however treated or mal-treated, always gives a perfect functional result. In cases where there has been marked forward displacement of the upper end of the shaft, there is often left an unsightly bony ridge running transversely across the front of the shoulder. I have often had young girls brought to me by their mothers a year or more after the receipt of this injury. They were deeply concerned about the disfigurement but in every case the function of the shoulder was normal, with perfect movement in every direction. In some cases I have assumed the role of a plastic surgeon and chiselled off the offending bony ridge, but only for the sake of appearances.

However, the fracture above all others in this region that demands our attention is the abduction fracture impacted or unimpacted. In this fracture there is angular convexity medially and the proximal end of the shaft is displaced medially in relation to the head. Though there is often an associated fracture of the greater tuberosity, this complication is not invariable. In the majority of impacted fractures the degree of displacement is not great and the key to treatment is early movement of the shoulder joint commencing in ten or twelve days. In the presence of impaction these fractures are best treated on an abduction splint at 90 degrees. If they are impacted the relative position of the fragments will not alter no matter in what position they are splinted. Accordingly we adhere to the previously enunciated principle that for all shoulder joint injuries the position of abduction is the one most favourable for the speedy restoration of joint movement, always provided that this position does not tend to cause redisplacement of fractured fragments after reduction. I grant that at times the surgeon may be uncertain whether impaction is actually present and may be disinclined to trust his own or the radiologist's interpretation of the X-ray film. In such case he must proceed by the method of trial and error and immediately after placing the limb on an abduction splint have a further X-ray taken. Should impaction not be present the degree of displacement will have become definitely increased and accordingly the splint must be immediately removed. The danger that the patient will subsequently be unable to bring his arm to his side has been greatly overrated. This fear need not be entertained unless there is extremely gross deformity in impaction. In such case the danger can be obviated by the compromise position of 45 degrees abduction instead of the usual 90 degrees. In the absence of a complicating dislocation of the head of the humerus operative reduction is never indicated in these impacted fractures. At the risk of wearying repetition let me emphasise the paramount importance of early movement in these impacted fractures. Movements can safely be performed in ten or twelve days.

It is the unimpacted fractures in this region that give us most food for thought. The unimpacted abduction fractures of the neck of the humerus and the fractures of the extreme upper end of the shaft are indistinguishable from one another in their behaviour and treatment. If we consider these two types of fracture as one it then becomes one of the commonest of all upper limb injuries. The nature of the displacement is very constant. The proximal end of the shaft moves upwards and inwards into the axilla whilst the small proximal fragment is abducted and externally rotated. Indeed the head may rotate through an angle of 120 degrees. As Watson-Jones conservatively remarked, it may be possible to reduce this fracture by manipulation. I would

like to add that this is rarely the case. The choice of treatment usually lies between the use of an abduction splint combined with traction and operative reduction.

Traction on an abduction splint is difficult and uncertain in its results unless certain essentials are fulfilled. It is useless to adhere to this line of treatment in a public hospital if the fracture resident is comparatively untrained and inexperienced. The abduction frame must be an accurate fit and obtain good purchase from the crest of the ilium. If the frame slips down the patient's body it will also drag the shaft of the humerus downwards, or in other words, perpetuate its medial displacement in relation to the head. Traction must be constant and uninterrupted and applied by a screw traction device which can be tightened by the unskilled. To treat these cases as out-patients is to invite failure. Close, persistent, skilled supervision is essential combined with frequent checking of the position by repeated X-ray examinations. Always provided that all these desiderata be complied with completely, the method is reliable, but in unskilled hands failure is certain. If reduction be secured and maintained by this method, the traction can be released at the end of four weeks and active movement then commenced. The worst splint to employ in an unimpacted abduction fracture is a Thomas arm splint with traction. It stands alone as a producer of intractable stiffness of the elbow, wrist and digits. Even the traction afforded by this splint is insufficient, because the ring of the Thomas splint affords but poor and inconstant counter-pressure against the chest wall. I hope that I have made it clear that the use of the abduction splint with traction is to be reserved for highly skilled hands. In inexperienced hands better results will be obtained by merely encircling the upper arm with aluminium gutter splints and binding the arm to the side with the elbow at a right angle. Even in the presence of a considerable degree of uncorrected deformity the functional results are very fair. Always provided that early movement commencing in about eighteen days is insisted upon. Such patients will regain elevation to about an angle of 120 degrees, the chief loss being the movement of rotation.

An appreciable percentage of these fractures calls for operative reduction, an operation which is by no means easy, particularly if the fracture be already a week or ten days old. In these fractures the difficulty is not to secure reduction by operation, but to retain it. The proximal fragment is too small for one to indulge in any form of metallic fixation. The old recommended method of sharpening the end of the shaft into a point and impacting it into the fractured surface of the head is futile. It calls for a balancing feat on the part of the head that it is most unlikely to perform. There is one method and one method only of internal fixation in these fractures, that is to use the long tendon of the biceps as a fixative agent. It is employed in practically identical fashion as its use in a Nicola operation for recurrent dislocation of the shoulder. The long tendon is divided at its junction with the muscle belly. A hole is drilled through the proximal head fragment from the centre of its articular cartilage out through the fractured surface and then through the distal fracture surface emerging obliquely on the anterior surface of the shaft. The long tendon is then pulled through this channel and sutured to the periostium on the front of the shaft and to its own distal end. This procedure reliably prevents any major re-displacement though it by no means produces complete immobilisation at the site of fracture. After the extensive dissection necessary for this operation it is advisable to immobilise the arm by the side for four weeks before commencing movement. This same operation is equally applicable to high fractures of the humeral shaft. I have never yet seen aseptic necrosis of the head of the humerus follow this operation.

Fracture dislocation of the shoulder joint is an uncommon and a grave injury. The fracture occurs in association with the common forward dislocation and undoubtedly the fracture occurs through the neck immediately after the dislocation has occurred. Unless massive swelling has already occurred, the clinical diagnosis is usually easy. By palpating the displaced head, one realises that it does not move when the arm is abducted. Manipulative reduction will usually succeed provided that the injury is not more than two or three days old. At a time later than that failure is almost certain. Only one method of reduction is likely

to succeed. The arm must be almost fully abducted and elevated above the head. Traction and counter traction applied and then with the fingers, but not with the booted heel, the head is pushed back into the glenoid fossa and the arm brought down to the side. If manipulative reduction prove impossible, it is best to perform an operative reduction. This will most probably be followed by avascular necrosis of the head. Indeed this unhappy sequel may follow a successful manipulative reduction. If the displaced head be left lying beneath the glenoid, it invariably causes painful symptoms. Even in the absence of positive physical signs of pressure on the nerve trunks of the brachial plexus there will be subjective symptoms of pain and of paraesthesiae. The occurrence of avascular necrosis may or may not call for the performance of an arthrodesis of the shoulder, the determination being based on the degree of pain present.

In connection with the injuries in this region, it may not be out of place to mention the somewhat rare posterior dislocation of the shoulder, about which little is written and less is generally known. It can occur from violence applied to the elbow whilst the arm is abducted and internally rotated or from a direct blow on the front of the shoulder. The head of the humerus passes backwards in the direction of, or into the infraspinous fossa of the scapula. The diagnosis is easily missed because the possibility is not usually envisaged by the examining surgeon. The rounded contour of the shoulder is certainly lost in front, but not to the same extent as in the common anterior dislocation, and there is a fullness over the posterior aspect of the shoulder. Both of these signs may be masked by swelling. Furthermore the arm lies by the side with the presence of slight internal rotation. The essential feature of this dislocation is not mentioned so far as I know in any modern text-book on fractures and dislocations. Reduction is easy, retention is difficult. Traction with the arm by the side or in slight abduction, combined with rotatory movements in both directions and direct pressure on the displaced head, will easily affect reduction. Frequently, however, the moment the arm is released, the head of the humerus promptly re-dislocates through the rent in the posterior capsule. The stable position for this dislocation is one with the elbow fixed behind the coronal plane of the body, and the arm abducted some 80 degrees from the side of the body. The only sure method of retaining this position is by means of a plaster-of-Paris shoulder spica.

In the four cases I have treated, I have maintained this position for six weeks. This may have been unnecessarily long, but I had no precedent to guide me. It is curious that in the modern literature no attention is paid to this dislocation, though rarer lesions receive due notice.

The College Library

THE Royal Australasian College of Surgeons is fortunate in possessing the largest number of historical medical and surgical books in this country. Housed in the Gordon Craig Library are two separate collections. The biggest and most important is the magnificent library formed by the late Dr. Leslie Cowlishaw, of Sydney, and purchased after his death in 1943 by the College; this is maintained as a complete and separate entity within the main library. The second collection is smaller but contains some very choice items purchased by the College on the advice of W. R. Le Fanu, Esq., the Librarian of the Royal College of Surgeons of England. In addition, there have been numerous gifts and bequests by many individuals and by a number of institutions. One gift of considerable interest is the collection of books on the history of medicine from the library of Rudyard Kipling, presented to the College by his widow.

It is impossible to over-emphasize the importance of the Cowlishaw Collection to students of the history of medicine in this country. When compared with the famous overseas libraries it is small, but it contains many treasures covering all aspects of medicine and surgery. Many of the items are so rare as to have become unobtainable on the present book market. Over and above the historical items the research worker has, in the Cowlishaw Collection, a wealth of biographies, bibliographies and books devoted to the history of medicine in general and in all its branches that is not available in any other library in Australia. There are also a number of journals, a large number of reprints of journal articles and fifteen hundred lantern slides devoted to the history of medicine.

It is proposed to publish in this Journal a series of short articles in which some of the books from the College Library will be illustrated and described.

Prohemium

Cyrurgia Magistri Guidonis de Cauliaco edita anno dñi. 1363. Scripta Tholose Montispessulani. Incipit liber.

Ostquam

First page of the *Cyrurgia* of Guy de Chauliac, Venice, 1499.

THE CYRURGIA OF GUY DE CHAULIAC

By K. F. Russell.

Department of Anatomy, University of Melbourne.

ONE of the most outstanding French surgeons of the Middle Ages was Guy de Chauliac. He was born in the village of Chauliac about the year 1300 and received his early education locally. Later he commenced his medical studies at the University of Montpellier. Before taking out his medical degree Guy travelled to Bologna where he studied anatomy under Nicholas Bertruccio. At this time Bologna was noted for its anatomical teaching, for here actual dissections on the human body were carried out, a practice started by Mondino da Luzzi in 1315, although the dissection was perfunctory and the anatomy was that of Galen. Next Guy travelled to Paris to improve his surgical knowledge and after a period at Lyons he returned to Montpellier to take out his degree, which he received about 1325.

Guy then settled in Avignon and, during his life, served as physician to Popes Clement VI, Innocent VI and Urban V. By 1363 he had finished writing his book on surgery and five years later (in 1368) he died.

His *Cyrurgia* was immediately popular and a large number of copies in manuscript were circulated in the XIVth and XVth centuries and it was translated into many languages. Nicaise (1890) lists a total of 56 copies that have survived in various languages although 22 of this number are copies of only part of his original treatise.

The first printed edition appeared in French published in Lyons in 1478 and by 1500 fourteen separate editions were printed in French, Latin, Spanish and Italian. During the XVIth century thirty-eight editions appeared in all languages and a further seventeen were added during the XVIIth century. The first edition in English was printed in 1542 although it had been available in manuscript in the XVth century.

His book commences with a brief introduction containing an historical sketch and in which the importance of surgery is discussed. Then follows a short anatomy of the body which is probably the weakest section of the book. It is the anatomy of Mondino and is little more than the superficial anatomy of a post-mortem examination; but it was due to Guy that the tradition of actual dissection spread from Bologna to Montpellier.

The bulk of the book is devoted to surgery and discusses the treatment of wounds and ulcers, the reduction of fractures and dislocations, leprosy, phlebotomy, the use of the cautery, preparation of medicines and other matters which concerned the surgeon of his time. His surgery follows the conventional lines of the period but there is evidence of considerable practical experience.

His surgical teaching included the early operative removal of cancer, the treatment of fractures with slings and extension by weights, operations for hernia and for cataract. He described various methods for controlling haemorrhage but was keen on the use of the actual cautery, salves and plasters in the treatment of wounds although he stressed the importance of removing foreign bodies.

Guy de Chauliac fills a very important place in the history of surgery and his book remained the principal French text until Ambrose Paré in the XVIth century reorganized the art and science of surgery and laid the foundation for its modern development.

The College Library possesses four copies of Guy's surgical text.

A. *Cyrurgia Guidonis de Cauliaco.* VENICE, 1499. Folio, 270 leaves.

Colophon:— *Venetiis impressus (impensis doni Andree Torresani de Asula) per Simonem de Luere.*
23 *mensis Decembris.* 1499.
Feliciter.

The first page of this copy is shown in the illustration. It is a magnificent copy, probably originally prepared for presentation as it has illuminated initials in gold and colours throughout. It will be noted that the initials shown in the illustration has a portrait miniature within it; this may represent either the original donor or the recipient.

Apart from the *Cyrurgia* of Guy de Chauliac this issue contains a number of tracts by other authors.

(a) *Recepta aquae balnei de Porrecta* of Tura de Castello.

(b) *Cyrurgia magna* of Bruno di Longoburgo.

(c) *Cyrurgia* edited by Theodorico Borgognoni, Bishop of Cervia (1205-1298).

(d) *Cyrurgia* edited by Roland of Parma.

(e) *Practica chirurgiae* of Roger of Palermo.

(f) *Cyrurgia parva* of Lanfranc of Milan (d. 1315).

(g) *Recollectae super quarto Canonis Avicennae* of Leonardo Bertapaglia (d. 1460).

(h) *De oculis* of Jesu Haly (Alî ibn Isâ).

(i) *De oculis* of Canamusali.

B. *La grande chirurgie de M. Guy de Chauliac medécin très-fameux de l'Université de Montpelier composée l'an de grace* 1363. *Restituée par M. Laurens Joubert.*

TOURNON: Par Claude Michel, 1598.

This French edition of Guy's work has the commentary of Laurent Joubert (1529-1583). The translation, which is probably the best to appear up to this date, was first printed for Joubert in 1579 and went through about sixteen editions.

Apart from the 1598 edition, the College also has the French editions, with the same title, printed at:—

TOURNON: Par Paul Frellon, MDCXIX.

and

LYON: Chez Jacques Ollier, MDCLIX.

REFERENCES.

CASTIGLIONI, A. (1946), "A History of Medicine." Translated by E. P. KRUMBHAAR,. New York. A. Knopf.

COWLISHAW, L. (1936), *Aust. N.Z. J. Surg.*, vol. 5, page 371.

NICAISE, E. (1890), "La grande chirurgie de Guy de Chauliac." Paris, Felix Alcan.

SINGER, C. (1925), "The evolution of Anatomy." London, Kegan Paul.

THORNTON, J. L. (1949), "Medical books, Libraries and Collectors." London, Grafton and Co.

MELANO-CARCINOMA OF THE CILIARY BODY.

By J. D. Hicks.

Royal Melbourne Hospital.

THE cellular structure and arrangement in malignant melanomata is such that for many years these tumours were designated melano-sarcoma. Whatever views may be held as to the origin of naevus cells, from basal epidermis (Dawson, 1925), from mesenchyme, or from specialized nerve cells (Masson, 1926), the varied histological appearance of different examples of melanoma is such that it is readily understood how Dawson (1925) was led to describe steps by which the naevus cells differentiated into melano-carcinoma, sarcoma, endothelioma and perithelioma, and melano-fibrosarcoma.

In a similar manner, the melanomata of the uveal tract have been classified by Callender *et alii* (1942) into spindle-cell and fascicular types, with one group, more malignant than the others, termed "epithelioid."

A true glandular or adenomatous structure, of obvious epithelial character, is apparently rare and it is thought worth while to report such a case, together with some comment as to the histogenesis of melanomata.

Case Report.

A woman of 58 years complained of symptoms suggesting glaucoma of the left eye. A pigmented nodule was seen in the iris of the left eye, between 5 o'clock and 6 o'clock. The eye was enucleated and on examination it felt hard and tense. The lens was tilted slightly to one side, the iris was circular in outline and quite normal except for a small thickening and projection in one corner, at its attachment to the ciliary body. The more or less disc-like nodule was 4 mm. in diameter and 2 mm. in thickness.

At low magnification (Fig. I) the situation of the tumour is well seen. It infiltrates the ciliary body, pushes forward into the anterior chamber at the base of the iris, and an oval polypoid mass extends into the posterior chamber, obviously displacing the lens to one side.

The tumour consists of small irregular acini of columnar epithelial cells which stain faintly with eosin (Fig. II). The lumens of the acini are generally small, and may not be obvious, as the eye is distracted by large clear vacuoles in the cells grouped about the lumens. The cells have abundant cytoplasm and in the majority fine brownish-black pigment granules are seen. Some cells are heavily pigmented. On focussing, the granules often may be seen scattered above and below, and at the sides of the vacuoles which are thus outlined as three-dimensional globules within the cell cytoplasm. The vacuole replaces most of the cytoplasm in some instances, giving a typical signet-ring appearance (Fig. III). The smaller and larger acini may be arranged irregularly or eccentrically about the lumen, or as columns of cells. They are supported by a loose connective tissue stroma containing thin-walled blood vessels.

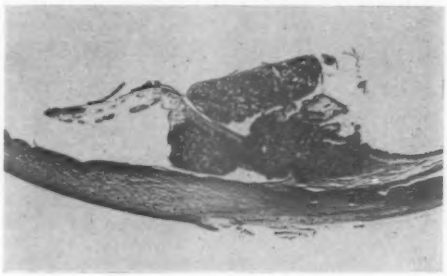

FIG. 1. The tumour is situated at the angle of the eye, involving the ciliary body and base of the iris, with a polypoid mass in the posterior chamber displacing the lens. (x 7.)

The rarity of the case may be judged from the fact that Callender, Wilder and Ash (1942) do not mention an example amongst their 500 cases of melanoma of the choroid and ciliary body, or amongst the 1600 cases of intra-ocular melanoma in the American Registry of Ophthalmologic Pathology. No account of this tumour is given by Duke-Elder (1940). Reports of similar cases are few in number; altogether about eight references have been found in the literature.

Although the condition of alveolar or adenomatous melanoma of the ciliary body is mentioned by Ewing (1940), and a short description is given by Parsons (1904), the papers mentioned by them are in journals not readily available. Barrow and Stallard (1932) report a partially pigmented tumour arising from the ciliary epithelium and infiltrating the ciliary body, containing

cystic spaces lined by pigmented epithelial cells in which there is evidence of secretory activity.

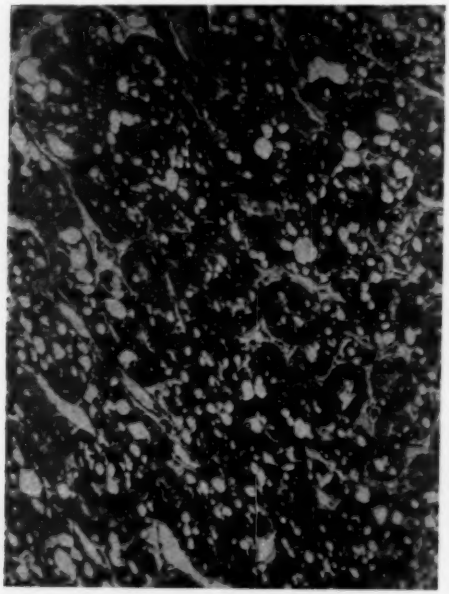

FIG. II. The alveolar structure is well seen. Numerous tubules are present with a small lumen. Many cells are distorted by large clear vacuoles. (x 180.)

The examples they found, described by other writers, were of similar nature and the case reported in this present paper also conforms with the general description.

The tumours typically invade the root of the iris, the ciliary body and the filtration angle. These glandular melanomata are essentially epithelial in structure. The cells are polygonal or columnar, arranged in rows or columns and sometimes, as in the present case, there is a definite structure of alveoli with a central lumen.

Occasionally "colloid" or mucoid "degeneration" is noted: in the present case cells ballooned with secretion are numerous. Some cells are pigmented, others are not.

HISTOGENESIS.

The epithelium covering the ciliary body and the posterior surface of the iris consists of two layers of cells. The outer layer develops from the upper and inner wall of the optic vesicle. It is a single layer of deeply pigmented cells, apparently unaltered throughout the *pars optica* and the *pars ciliaris retinae*.

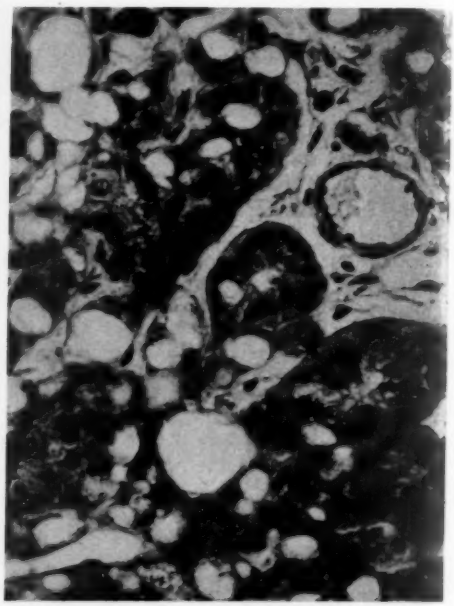

FIG. III. The cells contain numerous granules of pigment and the rather large clear vacuoles in many cells make location of the lumen of the alveoli difficult. (x 360.)

The inner or surface layer of cells comes from the invaginating wall of the optic vesicle which forms the inner folds of the optic cup — the multi-layered visual portion of the *pars optica retinae* which is reduced to a single layer of tall columnar cells, staining palely with eosin, in the *pars ciliaris retinae*. Over the iris this inner or posterior layer of cells becomes heavily pigmented, but in the region of the ciliary body the cells are either non-pigmented or contain only small numbers of pigment granules. These cells may be in part responsible for the secretion of the aqueous humour, and occasionally are seen to have clear vacuoles of secretion within their cytoplasm. They are neuro-epithelial in origin.

The similarity of the histological features of the cells composing the tumour to those of the cells on the surface of the ciliary

body is so unmistakeable that the direction in which the tumour cells have differentiated is quite clear, and presumably the tumour arises from this epithelium.

COMMENT.

There can be no argument as to this melanin-containing tumour being of epithelial type; indeed, it is neuro-epithelial. The melanin granules appear to be formed within the epithelial cells, practically all the cells containing granules in varying numbers throughout the cytoplasm, pigment being present but sparingly in the connective tissue. Formation of melanin is a normal activity of the inner layer of cells covering the ciliary body and iris and of the outer layer of the retina, ciliary body and iris. The tumour is clearly a neuro-epithelial melanoma.

This example should satisfy the thalamic responses both of those who adhere to the theory of the epithelial nature of melanomata, or to that of their neuro-ectodermal origin. Is it necessary to labour such doubtful distinctions?

It seems that the choroidal melanomata do not arise from epithelium, and certainly the retinal epithelium can generally be found lying intact above them in early cases at least.

The varying arguments about the formation of melanomata have been fully discussed by many authors. The views expressed by Willis (1948) are reasonable; that it is a mistake to try and devise a unified histogenetic hypothesis to embrace all types of melanotic tumours. Should we go further and say that the mistake is even more fundamental, that it is unwise to strive towards a histogenetic relationship between tumours and a fixed type of precursor cell, especially if such a theory necessitates the idea of strict adherence to a particular germ layer of ectoderm or mesoderm? The histogenetic view is valid only in so far as it can be shown to depend directly on histological structure. Where it is known that a similar functional capacity, in this instance the elaboration of melanin, is possessed by more than one histological cell-type it is not necessary to achieve a unification of the histogenesis. The histological features of any tumour, where they conform to recognizable patterns, are sufficient to indicate the classification or nomenclature, but can not be relied upon to denote the cells from which the tumour arose.

REFERENCES.

BARROW, R. H. Balfour and STALLARD, H. B. (1932), *Brit. J. Ophth*, vol. 16, page 98.

CALLENDER, G. R., WILDER, H. C. and ASH, J. E. (1942), *Amer. J. Ophth.*, vol. 25, page 962.

DAWSON, J. W. (1925), *Edin. Med. J.*, vol. 32, page 501.

EWING, J. (1940), "Neoplastic Diseases." Philadelphia. W. B. Saunders. Page 961.

MASSON, P. (1926), *Ann. d'anat. path.*, vol. 3, pages 417 and 657.

PARSONS, J. H. (1904), "The Pathology of the Eye," London, vol. 1, page 361.

WILLIS, R. A. (1948), "The Pathology of Tumours." London, Butterworth. page 916.

CASE REPORTS.

A CASE OF EXOMPHALOS WITH STRANGULATION OF THE EMBRYONIC MID-GUT IN UTERO ASSOCIATED WITH MICRO-COLON.

By H. M. KARN.

Dunedin.

THE following case is reported because it presents certain features which have not previously been described in the literature.

CASE REPORT.

Mrs. F., aged 35, a primipara, was delivered of a full-term male infant, weighing 6 lbs. 4 ozs., in an outside nursing home on 25th March, 1949. It was found to have a large glistening mass protruding from the umbilicus near a medium sized umbilical hernia. The mass was removed by the doctor after placing a catgut ligature round the base. No haemorrhage was noted from the mass, nor from the umbilical stump. The infant began vomiting a bile-stained fluid a few minutes after birth and was transferred to the Dunedin Hospital the same day.

On examination, the mouth and lips were covered with a recent, greenish, mucoid vomitus. The abdomen was distended with visible peristalsis in the left upper quadrant. A small umbilical hernia was present through which protruded a piece of catgut. There was no rectal obstruction, a finger being inserted with ease. A plain X-ray of the abdomen revealed gas in the upper quadrant which was thought to be in the stomach. After administration of subcutaneous saline the child was prepared for operation. A small tube was passed into the stomach which was aspirated and washed out with saline.

Operation.

Under open ether anaesthesia supplemented by a local field block of the abdominal wall a right paramedian incision was made. On opening the peritoneum a large sausage-shaped mass presented which ended below at the catgut ligature. This was assumed to be stomach and duodenum. The rest of the intestine was represented by a thin cord-like structure occupying the left flank of the abdominal cavity in continuity with the rectum. A rudimentary vascular arcade and a fine omentum were identified. Most of the small bowel and part of the large were obviously deficient. The thin distal loop of bowel was distended with saline injected by Clogg's method. A catheter was passed along the rectum, saline injected along it further distended the lumen of the bowel and dislodged some clay-coloured, putty-like material.

The distended proximal loop of bowel was evacuated of its contents by gastric suction and anastomosed side-to-side for about two inches with the supposed transverse colon. One layer of interrupted cotton sutures was used over a fine catheter to retain the patency of the anastomosis site. The rudimentary omentum was tacked down over the area. After dusting with penicillin powder the wound was closed in layers.

Post-operatively penicillin (50,000 units six hourly) and subcutaneous saline were given. Gastric suction produced about 250 cc. of bile-stained fluid daily. By the third day the infant took fluids fairly well by mouth but vomited unless gastric aspiration was carried out. On the fourth day there was a small bowel action of putty-like material. The infant collapsed while feeding on the sixth post-operative day and died in a few seconds.

Post-mortem examination (by Dr. I. A. Prior) showed a large amount of fresh blood-clot and haemorrhages present in the adventitia of the round ligament, lesser omentum and gastro-splenic ligaments. The oesophagus and stomach were dilated.

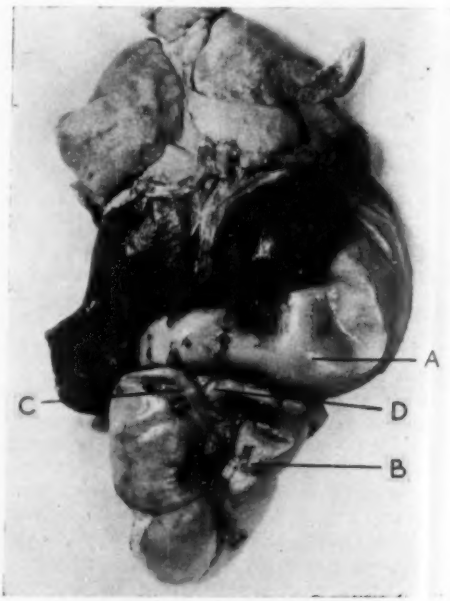

FIG. I. Thoracic and abdominal organs showing the dilated stomach, duodenum and jejunum with the blind ends of jejunum and colon lying adjacent to the pylorus.

A. Stomach.
B. Descending loop of the jejunum.
C. Blind end of ascending loop of jejunum.
D. Blind end of colon.

The pylorus admitted a fore-finger and was continuous with the dilated duodenum which passed posteriorly and across the midline to the left side. The jejunum passed forwards, downwards and then up to the region adjacent to the pylorus where it came to a blind end. The dilated duodenum and jejunum measured 3 cms. in diameter and 22 cms. in length.

Lying adjacent to the blind end of jejunum there was a firm round comma shaped mass which was continuous with a narrow portion of bowel 0.6 cms. in diameter. This passed to the left side and 12 cms. from its origin was anastomosed to the posterior aspect of descending loop of jejunum. The anastomosis was S-shaped and showed an acute kink and some recent blood clot covered the sutures.

The thin portion of bowel then passed in the left colic groove to the pelvis where it became continuous with the rectum. The total length of this portion of colon was 20 cms.

The lumen of the colon came to an abrupt stop and was involved in dense fibrous tissue in the region of its commencement. The remainder of the lumen was patent and below the anastomosis the contents were bile stained. The ostium of the anastomosis only admitted a fine probe. The remaining organs were normal.

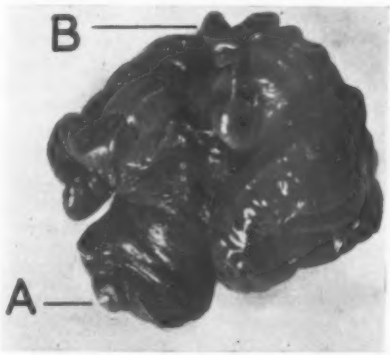

FIG. II. Portion of the bowel which presented at the umbilicus and which was removed after birth.
A. Point of attachment to the ventral abdominal wall.
B. Coils of bowel.

Dissection of portion of bowel which presented at umbilical site at birth, showed it to be a dark fan-shaped mass with a central firm area of mesentery around which small convoluted coils of bowel were present. This measured 8 cms. in length, 7 cms. across its widest part and was 2 cms. thick.

At a point two-thirds of the way around the circumference, a junction of bowel of smaller diameter with bowel of larger diameter could be seen. A primitive appendix was also present.

Tracing the smaller and larger bowel down to the apex of the mass they appeared to become fibrosed and no lumen could be demonstrated in this region.

Histological examination.

Sections from apex of mass showed it to be fibrous connective tissue which had undergone complete avascular necrosis with loss of cellular detail. Some large vessels showed marked obliterative changes in their lumina.

The surface was lined by a thin layer of darkly staining cells with elongated nuclei. There was no evidence of infarction. Serial sections showed the gradual appearance of bowel lumen on either side of the central area of connective tissue. Complete necrosis was present in all areas with the exception of a thin layer on the peritoneal surface.

The post-mortem findings were those of persistence of the embryological mid-gut with failure of subsequent withdrawal from the extra-embryonic coelom lying in the umbilical cord. No rotation of the mid-gut has occurred beyond the first stage when the pre-arterial segment moves down and to the right due to growth of the liver. Avascular necrosis of protruded mass of bowel has occurred.

DISCUSSION.

Rotation and reduction of the mid-gut loop must have commenced but was interfered with mechanically resulting in a strangulation of the loop in utero. This stage is generally accepted to occur at about the tenth week of intra-uterine life. It is highly interesting to assume that the foetus survived seven months in utero with an attached necrosed, but uninfected portion of bowel, equivalent to a strangulated hernia. There was no evidence of adhesions at operation.

ACUTE HAEMORRHAGIC PANCREATITIS IN A CHILD.

By David L. Dey.
Sydney.

Case History.

On the morning of 27th Sept., 1950, Anne H., aged 22 months, was quite well. About half an hour after her breakfast she came to her mother and complained of a pain in her abdomen. A few moments later she was suddenly stricken by a severe pain, associated with vomiting. This severe pain lasted some ten minutes, and during this period she writhed about the bed, drawing up her legs. On its passing she lay pale and exhausted.

She was brought directly to the Royal Alexandra Hospital for Children, where she was admitted, having had one further episode of pain and vomiting.

The child was seen soon after admission. She was profoundly collapsed, with blue lips and rapid respiration. Some flea bites were present on the neck and trunk. She appeared to be suffering from abdominal pain, but on palpation no rigidity was found, although she appeared slightly tender in the epigastrium, with some guarding in this area. Her temperature was sub-normal. There were no other abnormal physical findings.

In view of her history and age it was felt that a diagnosis of intussusception could not be excluded, although her general condition resembled that of an "acute toxaemia." She was given an anaesthetic, but on palpation no tumour could be felt, whilst a high colonic saline injection produced only a little faeces. Accordingly she was given serum intra-venously and intra-muscular injection of penicillin 100,000 units third hourly was instituted. Some charcoal was given by mouth after recovery from the anaesthetic — routine in this hospital in doubtful cases of intussusception.

The next day her general condition was a little better, but her temperature had risen to 102° F, her pulse and respirations were rapid, and her abdomen was beginning to distend. No bowel sounds could be heard, and she was somewhat tender in the upper abdomen. There was still no rigidity. A little of the charcoal appeared in a bowel wash. She had continued to vomit small amounts of greenish fluid. A plain X-ray film of her abdomen showed scattered distended loops of small bowel, with gas also in the colon. It was felt that this was not consistent with organic obstruction, and that her condition was one of paralytic ileus, probably resulting from peritonitis. In view of her age this was most likely to be the result of a ruptured appendix, but the diagnosis was not a satisfactory one.

A white cell count showed 24,000 cells per cmm., 98 per cent. being neutrophils. Gastric suction was instituted, a blood transfusion given, and laparotomy decided upon. This was performed through a right paramedian incision and showed:—

(a) much blood-stained peritoneal fluid, with distended loops of bowel.

(b) wide spread fat necrosis mainly affecting the omentum and the *appendices epiploicae.*

(c) a pancreas which was grossly hard and swollen, and which showed large haemorrhagic areas, viewed through the overlying peritoneum.

(d) an apparently normal biliary system.

The abdomen was closed without drainage.

Subsequent convalescence was worrying but free from major upset until the tenth day, when she burst her wound. This was re-sutured, the incident producing remarkably little disturbance. She was discharged on 8th Nov., 1950, and, when seen four months later, appeared little the worse for her experience.

Laboratory investigations failed to demonstrate any pancreatic dysfunction, but the doubtful value of the commonly employed stool fat tests robs this of any significance. There was no subsequent diabetic tendency.

Discussion.

This case is presented for publication as no report of the condition has been found in the literature in this age group. Pancreatitis of minor degree is of comparatively frequent occurrence in mumps (epidemic parotitis) and there is strong presumptive evidence that this was the aetiological factor here. Although the patient herself showed no sign of the disease her small sister was found to be suffering from mumps, by Dr. A. Darragh, of Mascot, two days after this child's admission to hospital. Whilst it has no direct bearing on the disease as seen in the adult, it is of considerable interest that a virus infection is apparently capable of precipitating the explosive process.

The fallibility of physical signs in acute abdominal disease in childhood is clearly shown — these, apart from the distension, were never striking, and, of themselves, gave no indication of the severity of the lesion.

Summary.

1. A case of acute haemorrhagic pancreatitis in a child of twenty-two months is reported.
2. The aetiological factor precipitating the condition appeared to be mumps (epidemic parotitis).

Books Reviewed.

LUMBAR PUNCTURE AND SPINAL ANALGESIA.

By Professor R. R. MACINTOSH, M.D., F.R.C.S.(Edin.), F.F.A.R.C.S. Edinburgh, Scotland: E. & S. Livingstone Ltd., 1951. 8¾" x 5¾", 149 pp., 111 figures. Price: 21s. net.

In the preface to this excellent contribution, the author gives his reasons for adding to the literature on this subject. Probably the most cogent one given is that the newly qualified house doctor, inadequately instructed in technique, is expected to administer spinal anaesthetics and has no adequate literature to which he can refer.

This problem is solved by this valuable book whose author is a master of lucid exposition, and had it been written twenty years ago, this form of analgesia would certainly have gained more popularity in this country; not that there is any particular advocacy expressed for spinal analgesia, but rather that if it is to be used, the operator should know what he is doing. To quote from the preface —"The factor most contributary to its tragic history is the ease with which it can be performed by anyone."

After a brief and interesting review of the early history, the anatomy involved in lumbar puncture is fully presented with lucid diagrams and illustrations. Then follow chapters on the cerebro-spinal fluid, sterilisation and the technique of lumbar puncture.

Chapter 7, "The distribution of analgesic solution," is of considerable interest in that previously held views of techniques, based on the assumption that 1:1500 Nupercaine is hyperbaric, now seem ill-founded. The point is made that, whatever the technique employed with this agent, the level of anaesthesia is dependent on the volume of fluid injected, rather than its specific gravity.

The book ends with a chapter on headache, followed by do's and don'ts. There is nothing one would wish to see omitted, and if any addition were made a rather more full discussion on the choice of subject for this form of anaesthesia would be of value, particularly in view of the object with which the book was written.

It is of clear type and written in a style that is easy and pleasant reading with a wealth of illustrations.

The author's appreciation of the assistance given by the artist is understandable.

LE SYSTÈME NEUROVASCULAIRE.

By GUY LAZORTHES. Paris: Masson et Cie, 1949. 10" x 6½", 71 illustrations. Price: 950 fr.

In recent years the French have made extensive contributions to our knowledge of the sympathetic nervous system and this book is a worthy addition to the valuable series of papers and monographs which have been written by a succession of distinguished investigators. It contains a review of earlier work and the results of the author's own investigations, as an anatomist and neuro-surgeon, over a period of 10 years.

The subject matter is conveniently arranged in five parts. The first, which follows conventional lines, is devoted to a general consideration of the centres and pathways concerned with the innervation of arteries and veins. Then follows a detailed description of the nerve supply of individual vessels, much of which is based on the author's investigations. Though his findings do not always coincide with those of earlier and contemporary writers, the observations recorded by him merit careful attention. Neuro-vascular mechanisms are fully discussed in the third part. The fourth part opens with a survey of the techniques employed to evaluate neuro-vascular disturbances and pain of vascular origin. The principles governing the surgery of neuro-vascular systems are discussed in the last section which concludes with an account of such procedures as infiltration of pathways and centres, peri-arterial sympathectomy and operations on the sympathetic chain. The present time is a particularly appropriate one to review our knowledge of this subject because many surgeons have become disheartened by their failure to obtain and maintain total sympathetic denervation of selected tissues. Numerous factors undoubtedly contribute to this, but there is little doubt that some embark on surgical procedures without the requisite knowledge of the structure and function of the sympathetic nervous system, and this may be one factor responsible for the disappointing and conflicting results which cloud surgical literature. The book is a valuable contribution to the subject and will repay study by those anatomists, physiologists and surgeons who are working in this field.

THE ESSENTIALS OF MODERN SURGERY.

By R. M. HANDFIELD-JONES, M.C., M.S., F.R.C.S., and Sir ARTHUR E. PORRITT, K.C.M.G., C.B.E., M.A., M.Ch., F.R.C.S. Fourth Edition. Edinburgh: E. and S. Livingstone Ltd., 1951. 9½" x 6", 1,263 pp., 641 illustrations. Price: 55s. sterling.

The fourth edition of this well-known text-book maintains the high standard of its predecessors. As a result of the passage of the years there has been a necessary change in the personnel of the contributors, though most of the chapters have been written by the editors.

The steady demand for this book is likely to be continued. The general presentation of material is very good, although in an attempt to keep the book within reasonable limits there is, in places, a brevity which is inclined to give a false impression, though on the other hand it allows (in the available space) a satisfactorily wide presentation of most of the subjects.

The principal criticism is that in many of the general sections very little attempt has been made to deal with these except in a perfunctory manner and they cannot be regarded as being satisfactory for a student of the subject. This is not peculiar to the text-book under discussion but applies to many general surgical works. The introductory chapters appear often to be included merely from a sense of duty or because of precedent rather than

because it is thought that they will be of any real value. To mention just one example here, the discussion of shock would not give a student any real idea of the rapidly increasing range of this subject in modern research.

Despite some of these minor criticisms it may be said that the presentation of material is good, that the illustrations, some of which are in colour, are good, and there is an adequate index. It might be noted that on the title page it is said that there are 644 illustrations, whereas only 641 are contained in the text.

This book can be recommended to such students of surgery as wish to find a reasonably adequate, if somewhat brief discussion, of the whole of this very large field within the confines of a single volume.

PATTERNS OF DISEASE ON A BASIS OF PHYSIOLOGIC PATHOLOGY.

By FRANK L. APPERLY, M.A., M.D.(Oxford), D.Sc. (Melbourne), F.R.C.P. Philadelphia: J. B. Lippincott Co., 1951. 9½" x 6½", 456 pp., 50 figures. Price: 86s.

Professor Apperly in this book has given us something quite different from the usual standard works on pathology. Throughout the volume the various disease processes are discussed from a functional point of view and a good deal of space is devoted to the physiology of the various systems. This has meant that some diseases are little more than mentioned, for example, carcinoma of the small bowel and haemachromatosis. The chapter on diseases of the thyroid must, on any standards, be regarded as inadequate.

There is an intentional lack of detail in the book which anyone seriously interested in the subject could not condone. Many strange statements appear, such as on page 128: "The cancer cells jump and penetrate the capsule faster than it is formed."

Although the book contains a large amount of information attractively presented, the reviewer would hesitate to recommend it to undergraduate students as a text-book or to post-graduates for reference. The lack of a bibliography, from the latter point of view, further diminishes its value.

Book Received.

SURGICAL NURSING AND AFTER-TREATMENT.

By H. C. R. DARLING and T. EDWARD WILSON. Tenth Edition. London: J. and A. Churchill Ltd., 1951. 7½" x 5", ix plus 630 pp., 188 figures. Price: 16s.